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ABSTRACT

This resource guide focuses on handling library materials that are too deteriorated to benefit from other preservation treatments. Hopeless case items, that would require an unreasonable amount of conservation work to fix, can be resolved through a process of reselecting items by replacing them or reformatting them. The reselection integrates preservation with collection development, acquisitions, cataloguing, circulation, and public service. The following articles are presented as guides to replacement and reformatting: (1) "Replacement for Brittle Items" (Emory University) and "Preservation Decision Making: A Descriptive Model" (Yale University) (Association of Research Libraries Office of Management Services); (2) "Brittle Book Preservation Policies" and "Replacement/Reformatting Options for Brittle and Missing Materials" (Columbia University Libraries); (3) "Cornell, Yale Advance with Digital Technologies" and "Special Report: Research on the Use of Color Microfilm" (Commission on Preservation and Access); (4) "RLG Preservation Microfilming Handbook: Operational Impact of Filming Projects on Library Units" (Nancy E. Elkington, Ed.); (5) "Preservation Microfilming" and "Preservation Decision Flow Chart" (Nancy Gwinn); and (6) "Preserving Harvard's Collections: The Acidic and Brittle Paper Problem and its Solutions" and "Preservation Workflow for a Worn, Damaged, or Deteriorated Book in the Research Collection" (Harvard University). A list of 13 selected resources recommends additional reading. (SLD)

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Conservation Planning Program

Options for Replacing and Reformatting Deteriorated Materials

By
Jennifer Hain
Preservation and Conservation Librarian
Massachusetts Institute of Technology Libraries

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January 1993

Series Editor
Jutta Reed-Scott
Senior Program Officer for Preservation and Collection Services

Managing Editor
C. Brigid Welch
Senior Program Officer for Information Services

Production Assistant
Annette C. Verna
Program Assistant for Publications

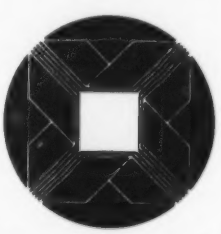

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Table of Contents

Preface iii

Introduction and Program Description
Overview 1

Definitions 1

Current Practice 3

Organizational Issues 8

Selected Documents
ARL Office of Management Services
Emory University, Replacement for Brittle Items 13
Yale University, Preservation Decision-Making: A Descriptive Model 15

Columbia University Libraries
Brittle Book Preservation Policies 21
Replacement/Reformatting Options for Brittle and Missing Materials 25

The Commission on Preservation and Access
Cornell, Yale Advance with Digital Technologies 29
Special Report: Research on the Use of Color Microfilm 31

Nancy Elkington
RLG Preservation Microfilming Handbook
Operational Impact of Filming Projects on Library Units 33

Nancy Gwinn
Preservation Microfilming
Preservation Decision Flow Chart 39

Harvard University
Preserving Harvard's Collections
The Acidic and Brittle Paper Problem and its Solutions 41
Preservation Workflow 49

Selected Readings 51

Preface

This is one of seven in a series of Preservation Planning Program (PPP) resource guides. Support for their preparation was provided by a grant from the National Endowment for the Humanities. The resource guides offer libraries comprehensive, easy-to-use information relating to the major components of a preservation program. The goal in each case is to construct a conceptual framework to facilitate preservation decisionmaking as it relates to a specific program area. ARL was fortunate to be able to draw on the extensive experience of a diverse group of preservation administrators to prepare these resources. Guides cover the following topics:

- Options for Replacing and Reformatting Deteriorated Materials
- Collections Conservation
- Commercial Library Binding
- Collections Maintenance and Improvement Program
- Disaster Preparedness
- Staff Training and User Awareness in Preservation Management
- Organizing Preservation Activities

Taken together, the guides serve as points of departure for a library's assessment of current practices. From the rich and diverse preservation literature, materials have been selected that relate principles or standardized procedures and approaches. The intent is to provide normative information against which a library can measure its preservation efforts and enhance existing preservation activities or develop new ones. The resource guides build on the body of preservation literature that has been published over the last decade. Every effort has been made to reflect the state of knowledge as of mid-1992.

The resource guides were prepared primarily for use with the *Preservation Planning Program Manual* developed and tested by the Association of Research Libraries, with support from the National Endowment for the Humanities. However, they prove useful to all those involved in preservation work in academic and research libraries. The guides may be used individually or as a set.

Each resource guide is divided into four sections. The first presents an overview and defines the specific preservation program component. The second section guides the review of current practice, explores the developmental phases that can be expected as a preservation program component develops, and lists specific functions and activities. The third part brings together key articles, guidelines, standards, and excerpts from the published and unpublished sources. The last section contains a selected bibliography of additional readings and audiovisual materials that provide additional information on a specialized aspect of each topic.

As libraries continue efforts to plan and implement comprehensive preservation programs, it is hoped that the resource guides will help to identify means of development and change and contribute to institutional efforts to meet the preservation challenge.

Jutta Reed-Scott
Senior Program Officer for Preservation and Collection Services
Association of Research Libraries

INTRODUCTION AND PROGRAM DESCRIPTION

Overview

Libraries can undertake a range of preservation initiatives (described in other guides in this series) to diminish greatly the overall deterioration of the physical materials and to conserve specific items. This guide will focus on options for handling materials that are too deteriorated to benefit from other preservation treatments. These "hopeless cases"--items that would require an unreasonable amount of conservation work to fix--can be resolved through a process of "reselecting" items either by replacing or reformatting them. The reselection process integrates preservation with collection development, acquisitions, cataloging, circulation, and public services, both for planning for a replacement and reformatting program and in daily work.

When planning for preservation, libraries should be guided by their collection and service missions, and should consider as well the potential for interdependent relationships with other institutions. In preservation, and especially in replacement and reformatting work, it is *very* important to recognize that no single library can save every volume, but many libraries acting in coordination can save millions of works. While each library will want to assess the condition of its collection and set its own priorities for preservation action, the library should make its plans in the context of the nationwide preservation effort to both benefit from and contribute to the work of other libraries. Funding programs, such as the Preservation Program of The National Endowment for the Humanities (NEH), are directed at preserving as many different titles as possible. These NEH-supported projects demonstrate how effective the collaborative process can be in both preserving materials and in improving bibliographic access to that material.

As this guide explains, the options for replacement and reformatting are increasing. Libraries will need to develop their own balance of choices based on need and resources. Common reasons for considering a replacement and reformatting program are: brittle paper, pervasive damage from heavy use, mutilation or disaster, or loss of material through theft or accident. A library may also recognize a need to protect valuable items by providing use copies.

This period is a very dynamic time in three key areas: electronic information technologies, copyright, and standards development. Staff can anticipate that the implications for libraries and for preservation will be significant. Libraries using this guide should acquaint themselves with current information in these areas before making assumptions about how to configure a preservation replacement and/or reformatting program.

Definitions

The terms "replacement" and "reformatting" serve as shorthand for a wide spectrum of activities, with clear distinctions evident at each end, but with many overlapping and interrelated activities along the spectrum. The similarities and distinctions are examined below.

"Replacement" is a routine function in most libraries, one so familiar that it hardly needs definition. It is commonly performed without any preservation involvement whatsoever. In this guide, however, replacement is a preservation function and "preservation replacement" is different from "replacement" done without awareness of preservation concerns. Further, this guide argues that the library practicing "preservation replacement" is using its dollars more effectively because it avoids compounding the problem of poor quality materials.

Factors common to both replacement and reformatting are:

- the deterioration in the text block (the pages) is extensive. Bindings can be replaced, but deteriorated paper is extremely time-consuming and expensive to treat with current technology; such treatments are only reasonable to do with volumes that have intrinsic or artifact value.

- the volume has no artifact value, but does have intellectual content that is worthwhile to retain. (If a volume has no value either as an artifact or as intellectual content, the library has the option to deselect and discard that item.)

- replacement and reformatting both involve substantial work beyond the preservation unit: circulation, collection development review and reselection, acquisitions, and cataloging functions. The cataloging work usually involves withdrawing the deteriorated copy as well as adding the new one.

- the cataloging step offers a retrospective conversion opportunity; in fact, an online catalog record may be a required component of grant-funded preservation microfilming work.

- copyright can be a constraint on reproducing a volume, especially when making a digital version of a volume. As part of developing a replacement and/or reformatting program, the library should seek information about the current status of the debate about copyright and intellectual property right issues.

Distinctions made between replacement and reformatting include:

- the method of acquisition: When seeking a replacement, the library usually turns to market sources of copies already in existence to acquire a new copy. When reformatting, the library becomes the producer of a new version of the work, usually going from paper to microfilm.

- the similarity of the new copy to the original: a replacement copy may be an exact physical duplicate of the original, but may also be a purchased microform. Likewise a reformatted version is usually a change of format, but computer technology will soon provide the means for producing paper, microform, and digital versions interchangeably. These types of distinctions blur when the example is a photocopy produced by library staff. The photocopy physically resembles a replacement copy, but in terms of operations, is similar to a reformatted version.

- the extent of access: when microforms and digitized copies are produced, master, or back-up copies are also retained. Additional use copies can be replicated on demand at very low cost. These versions lend themselves readily to cooperative access among libraries. A replacement or photocopy, being a single copy without a specific back-up, is not quite as quickly replicated for ownership by other institutions and users, although replacements and photocopies can certainly be shared through interlibrary loan. In any case, bibliographic access is also extremely important, since it allows users and other preservation programs to see what is available.

- the method of access: microforms and digitized copies require the use of special equipment to view the information. Many people simply dislike using microform readers or reading from a computer terminal and prefer to reformat the information to a paper printout immediately. Others willingly use microforms and digital formats, provided that good equipment is available. The library should consider whether the printed volume, microform, or digitized version best addresses collection and service goals.

Current Practice

Work Flow. The preservation dilemma--too few resources to support all the work that should be done--has forced libraries, singly and in collaboration, to define priorities and to try to find ways to manage large backlogs of deteriorated materials that await treatment of some sort. In their best efforts to make tough choices, libraries have debated several questions: Should priority be based on current use or on long-term intellectual value? Should the original format be preferred over microfilm? When a volume has been reformatted, should the original be retained or discarded? Current practice, therefore, is not uniform among libraries, but modified by institutional philosophy and circumstances.

Most libraries already contain overwhelming numbers of volumes that should be replaced or reformatted. Simply managing this deteriorated material until decisions can be made or projects funded is a challenge. Volumes that cannot be replaced immediately or reformatted can be assigned to "phased" treatment in which the first phase is a protective box or wrapper ("phase box"). It may be more expedient to move the worst material to a protected storage area just to keep brittle paper fragments from being lost.

Work flow varies among libraries, as is clearly shown in the examples shared in Jan Merrill-Oldham's and Gay Walker's *Brittle Books Programs,* issued as SPEC Kit 152 (Washington, DC: Office of Management Services, Association of Research Libraries, March 1989).

Current Use Materials. The criteria for selecting materials controls the work flow. The steps listed below describe common practice if the criterion for selection of items is *current use* (often described as a "use-based" approach).

1. Circulation desk staff and shelvers spot problem items and send them for preservation review.

2. Preservation staff review the item to see if it can be repaired; items that cannot be repaired go into a collection review process.

3. Collection review involves bibliographic searching to locate any duplicate copies or related volumes, and a report on any replacement publications that might be available.

4. If the reviewer decides the item is worth replacing and a copy is available, the acquisitions department orders it.

5. If no copy is available, the reviewer decides whether a microfilm or photocopy would be a better choice for a reformatted copy.

6. The microfilm or photocopy is produced by the preservation staff or by an outside service.

7. The new copy (paper or film) is cataloged, and the deteriorated copy is withdrawn.

8. The circulation staff notify the user (if someone is waiting for the item).

Collection-based Projects. Collection-based projects, in which a specific subject collection is the focal point, regardless of recent use, usually need grant funding to support the work. Work flow for collection-based projects begins with collection management recommendations about important subject collections. Next, a sample search is conducted to ascertain what proportion of the material is available from in-print or microfilm sources versus material that has not yet been reproduced. Funding sources for purchasing replacement volumes or microforms may be difficult to identify, but grant funding can be secured to make microfilm copies of otherwise unavailable titles.

Based on the results of the sample searching, the library assesses the funding the project will require and submits a grant application. Successful grant recipients then carry out the following steps:

1. Beginning a comprehensive bibliographic search process to filter out the titles that already have been microfilmed elsewhere so that efforts can be focused just on the "new" titles.

2. Establishing an "intent to film" record on a national cataloging utility (OCLC or RLIN) for each title selected in order to alert other libraries that they need not devote their resources to preserving these titles.

3. Preparing the volumes for microfilming, carrying out the photographic work, and inspecting the resulting film.

4. Upgrading or supplanting the "intent to film" records with standard bibliographic records for the new microfilm copies.

5. Sending the preservation master microfilm (the camera negative) to secure storage in proper environmental conditions.

Replacement Options. The process of acquiring a preservation replacement relies on many of the same steps needed by the library for its normal acquisitions and collections work. Replacements may be acquired through the following routes:

1) **In-print sources.** Selected classics and scholarly works in bound volume format are readily available from publishers, many of whom are using preservation-quality papers. These resources are standard for collection development and acquisitions work, but the preservation perspective will help insure that paper quality is part of the selection decision. In-print sources also include the microform publishers who have microfilmed large collections of older monographs in defined subject areas as well as many periodical runs. Some of these items can be purchased on a title-by-title basis; others are only available as part of the publisher's set.

2) **Out-of-print.** A number of book dealers offer to search for out-of-print books or specialize in providing out-of-print and secondhand books to research libraries. Also, libraries can advertise desiderata lists or use on-line services to locate items. The attraction of buying a secondhand copy is the chance to duplicate the library's copy exactly. The pitfall is that if the

library's copy is brittle, the secondhand copy will be at least acidic and quite possibly brittle, too. The library should order the secondhand copy on approval and be sure to examine the paper and binding quality carefully before making a purchase decision. The secondhand copy could need nearly the same preservation treatment that the deteriorated copy does.

3) **Gifts.** Donations to libraries may contain the exact volume needed to replace a deteriorated copy, but the same caution as described for secondhand volumes should be applied to gifts. Gifts may have been stored in unsuitable locations that caused accelerated deterioration of the paper. On the other hand, the gift copy may have received very little use, so its outward appearance could be quite good in comparison to the condition of the library's copy. A careful assessment of the physical condition will provide the opportunity to make a sound long-term decision.

4) **Photocopy.** (**Note:** Photocopy is included in the reformatting section even though it is a new copy in the same format. Photocopies produced in-house are more similar in work flow to reformatting activities and do not involve the same acquisitions steps as a purchased or gift copy.)

5) **Customized publishing.** A library or group of libraries may contract with a publisher to reprint a title, set, or collection that is otherwise unavailable in acceptable condition. Depending on the goals of the project, the result may be produced either in volume format or in microform, or both. These arrangements may be private between the publisher and library or, in the right circumstances, be the basis for a commercial agreement in which the publisher sells additional copies and pays the library an agreed upon fee.

6) **Combination of repair and replacement.** Even though a volume may have extensive deterioration, there may be components, such as illustration pages, that the library prefers to save. For example, a volume composed of text sections on brittle paper and illustration sections on better paper may be preserved by photocopying the text pages and combining them with the original illustration pages in a new binding. This effort is especially worthwhile if the illustration pages can be de-acidified as part of the repair process.

Reformatting Options. In contrast with replacement work described above, libraries that are just beginning their preservation programs do not commonly have on-staff experience in any type of reformatting work other than routine photocopying. Guides, workshops, and on-site visits to other preservation facilities are three fairly quick ways that staff can gain familiarity with this function. Scanning and digitization projects require a level of technical expertise that may not be readily available to library staff.

1) **Microforms.** Capturing text and illustrations in photographic images on microfilm is the predominant reformatting option. Preservation microfilm consists of three film generations: 1) the camera negative or preservation master microfilm, which is stored in a secure, stable environment as insurance against loss of the other copies; 2) the duplicate negative, called a printing master or service master, from which subsequent copies are made; and 3) the positive film or use copy, which is made available to readers. A fourth component of a preservation microfilm is either an OCLC or RLIN bibliographic record, as well as a record in the library's local catalog.

Microfilm production can be handled by an in-house unit, or can be contracted out to one of a number of preservation microfilm services. While roll microfilm is the fully accepted preservation format, microfiche is also an option if the greater reduction ratio of microfiche does not detract from the quality of the image when it is enlarged. Up to now, microfilm for preservation purposes has been exclusively black and white without a satisfactory gray scale for illustrations, an obvious limitation for the visual components of materials. Color microfilm of preservation quality is just now being tested with very encouraging results. Black-and-white microfilm, a technology that has been developed over decades, has well-established standards that insure quality for preservation purposes. The entire preservation microfilming process is thoroughly described in two excellent guides:

PRESERVATION MICROFILMING: A Guide for Librarians and Archivists, edited by Nancy E. Gwinn. Chicago: American Library Association, 1987.

RLG PRESERVATION MICROFILMING HANDBOOK, edited by Nancy K. Elkington. Mountain View, Calif.: The Research Libraries Group, Inc., March 1992.

2) **Photocopies.** A photocopy of an entire volume may be produced to substitute for a deteriorated copy. If the library's own copy is not sufficiently intact to produce a complete text, the library may seek permission to photocopy another library's copy. If the library's copy is complete, the library may wish to pay an outside service to produce the photocopy from the library's copy, or the library may run its own preservation photocopy service. In any case, the equipment must operate properly so that the print fuses to the paper. The National Archives has investigated the fusing process, and this research will be included in an American Library Association (ALA) guide, now in final edit, being prepared by the Reproduction of Library Materials Section (a subset of the Association for Library Collections and Technical Services, within ALA). The guide will describe how to photocopy whole books, not just individual pages.

3) **Digital versions.** Preservation librarians are experimenting with projects to use computing technology to scan text and graphic images for preservation projects. In the processes currently available for preservation work, the scanning results in a "bit-map" of the black-and-white areas that can be reproduced as a picture of the original page, similar to the telefacsimile process, but with much finer detail. This digital version can be produced either from the paper or from microform. Once digitized, the images can be transmitted electronically or reformatted back to paper or microform. In this process, the text and illustration captions must be indexed to allow for searching, but work being done with the more sophisticated technology of optical character recognition (OCR) scanning will produce a digital version in which the full text is searchable word by word. Capturing illustrations digitally requires further research, but should prove to be a viable option.

Cornell University, Yale University, the National Library of Medicine, and others are experimenting with digitizing for preservation purposes.

Evaluating Options. Choosing between a print/paper copy and a nonprint format of a work is a decision basic to the replacement and reformatting process. While the long-term advantages of microforms make a convincing argument to preservation staff, collection development and public services staff regularly hear the complaints of users who dislike using this format. Some libraries have adopted the preference of supporting local users by maintaining the paper format, if not through repair, then through replacement or photocopy. Microfilm is used as the last

resort. On the other hand, in grant-funded projects, the objective is to produce preservation microfilm and thereby greatly increase the access potential for a broad array of users, current and potential. The library might judge that printing new paper copies from the microfilm for selected microfilmed works (for example, materials needed for the reference collection) is warranted. The Columbia University Libraries brittle books brochure, contained in the accompanying material, clearly states what criteria are used to select print versus nonprint options.

Microforms, produced and stored properly, are an excellent preservation medium because those images will last hundreds of years. To read them, people will need only a light source and a magnifying lens, whereas today's computer file can't be read unless it is accessed on the proper hardware using the required software. Current experience shows that even 10-year-old computer files can be impossible to access because the necessary equipment and software have become obsolete and been discarded.

With the recognition that these problems remain to be resolved, it is clear that digital versions will play an important part in preservation. Both libraries and users are looking to the promise of electronic information technologies to respond to an information culture that expects increasingly rapid delivery of text and image over electronic networks.

Technologies that combine the virtues of microforms and digital versions are the subjects of several experiments. For example, in Yale's project, the plan is to take existing microfilm and reformat it to digital versions which can then be transmitted and accessed as computer files. The Cornell project's primary focus is digitizing from the paper copy to produce both an electronic and a paper version of the original; a microform copy will later be generated from the digital version. Whatever the reformatting method, special attention should be given to the illustrated materials.

The emergence of interrelated digital, paper, and microform technologies and their development into standardized applications will increase the options available for preservation uses. These combinations can be used to achieve the joint goals of longevity and easy access to research materials.

Development Phases. The library should determine which preservation program choices best fit its collections, needs, and resources. Reformatting and replacement are the natural partners of a repair and conservation program, but even if the library has no conservation unit, it can still carry out preservation replacement and reformatting work.

1) **Identify needs and priorities.** The library administration, circulation, collection development, acquisitions (monographs and serials), cataloging, and preservation staffs all have a role to play in defining needs, setting priorities, and developing policy and procedures for replacement and reformatting. Tools for assessing needs include condition surveys, circulation (use) data, and related analytical methods (for example, UC Berkeley's CALIPR) that help to establish priorities. Upon examining needs and priorities, many libraries decide that they need a routine approach to replacement that gives priority to items in use versus those in the stacks. Reformatting may become a routine activity as well, depending on the resources available; commonly, however, reformatting is dependent on grant funding and occurs on a project basis, perhaps using an outside microfilming service.

2) **Identify resources available.** Replacement and reformatting work both require funding, in addition to staff time. The library should first consider what funding might already exist for this work. More than likely, some money has long been identified for replacement purchases. If this money can be established as the base of the preservation replacement account, the library is over the first hurdle and can begin a basic, if small, program.

If no money can be immediately identified or reallocated within the existing budget, some planning for funding is the first step. The planning should include assessment of needs and priorities to establish a dollar goal. Ideas which have been used in other institutions to establish and support preservation include: 1) a Friends of the Library fund; 2) proceeds from sales of unwanted gift books; 3) fine money; 4) a small "maintenance" levy on the collections budget; 5) a grant for a special replacement or reformatting project (government, foundation, or private donor grants); or 6) special fund-raising efforts.

3) **Define level and scope of the program.** Preservation replacement and reformatting are activities that can be performed on a volume-by-volume basis or on a collection basis. This can be viewed as ongoing work or as a specific project. Obviously, the larger the number of items handled within a given time, the greater the impact on staff and financial resources. Several questions that may help define level and scope of the program are:

- What emphasis does the collection development policy place on maintaining retrospective collections?
- What are the opportunities for collaboration with other libraries?
- What needs and preferences do users have?
- If a user is waiting for an item, how is timeliness addressed?

Organizational Issues

Preservation replacement and reformatting are usually allied to a repair and conservation program so that the items that are too deteriorated can be channelled into a separate work flow of reselection and related steps. The sample flow charts, included in the accompanying materials, show where replacement and reformatting decisions are made in the preservation processes of several libraries.

Some aspects of replacement and reformatting work can be handled very effectively by contracting the work to an outside service. The library should consider the staff, space, training, equipment, and purchase costs to compare them to the fees an outside service would charge for the same result. The University of Pennsylvania has investigated this issue and determined that using outside services for several replacement and reformatting activities would be preferable to increasing the size of the on-site preservation operation. The third choice a library can make is to contract with an outside microfilmer to perform the work on-site in the library. This may be desirable if collection security is of special concern.

Cooperation among libraries is the key strategy to preserving a significant portion of the intellectual record. The NEH funding for preservation microfilming is, in itself, a major cooperative project in which libraries may conduct their projects independently, as well as contribute to a commonly accessible pool of resources. Libraries that have overlapping or complementary collections and user needs may find formal cooperative projects to be an effective preservation strategy, providing that the project includes mutual and rapid access to the preserved materials. Examples of cooperative microfilming projects are those of the Research Libraries Group and SOLINET.

SELECTED DOCUMENTS

Selected Documents

"The Acidic and Brittle Paper Problem and its Solutions", in *Preserving Harvard's Retrospective Collections; Report of the Harvard University Library Task Group on Collection Preservation Priorities.* Cambridge, MA: Harvard University Library Preservation Office, April 1991, pp. 63-70.

"Brittle Book Preservation Policies." New York: Columbia University Libraries, Preservation Division, 1991. Prepared for the Columbia University Libraries by Janet Gertz, assistant director for preservation.

"Cornell, Yale Advance with Digital Technologies", in *The Commission on Preservation and Access Newsletter* 50, October 1992. Released with the permission of the Commission on Preservation and Access, Washington, DC.

Elkington, Nancy E., ed. *RLG Preservation Microfilming Handbook.* Mountain View, Calif.: The Research Libraries Group, Inc., March 1992. pp. 65-66; 180-182. Reproduced by permission of The Research Libraries Group, Inc.

"Replacement/Reformatting Options for Brittle and Missing Materials," in *The Preservation of Library Materials: A CUL Handbook.* 5th ed. New York: Columbia University Libraries, Preservation Department, 1991. Prepared for the Columbia University Libraries by Janet Gertz, assistant director for preservation.

"Special Report: Research on the Use of Color Microfilm" in the *Commission on Preservation and Access Newsletter* 49, September 1992, pp. 3-4. Released with the permission of the Commission on Preservation and Access, Washington, DC.

Yale University Libraries. "Preservation Decision-Making: A Descriptive Model," in "Brittle Books Programs," *SPEC Kit 152.* Washington, DC: Association of Research Libraries, Office of Management Services, March 1989, pp.31-35.

Preservation decision-making workflow charts from:

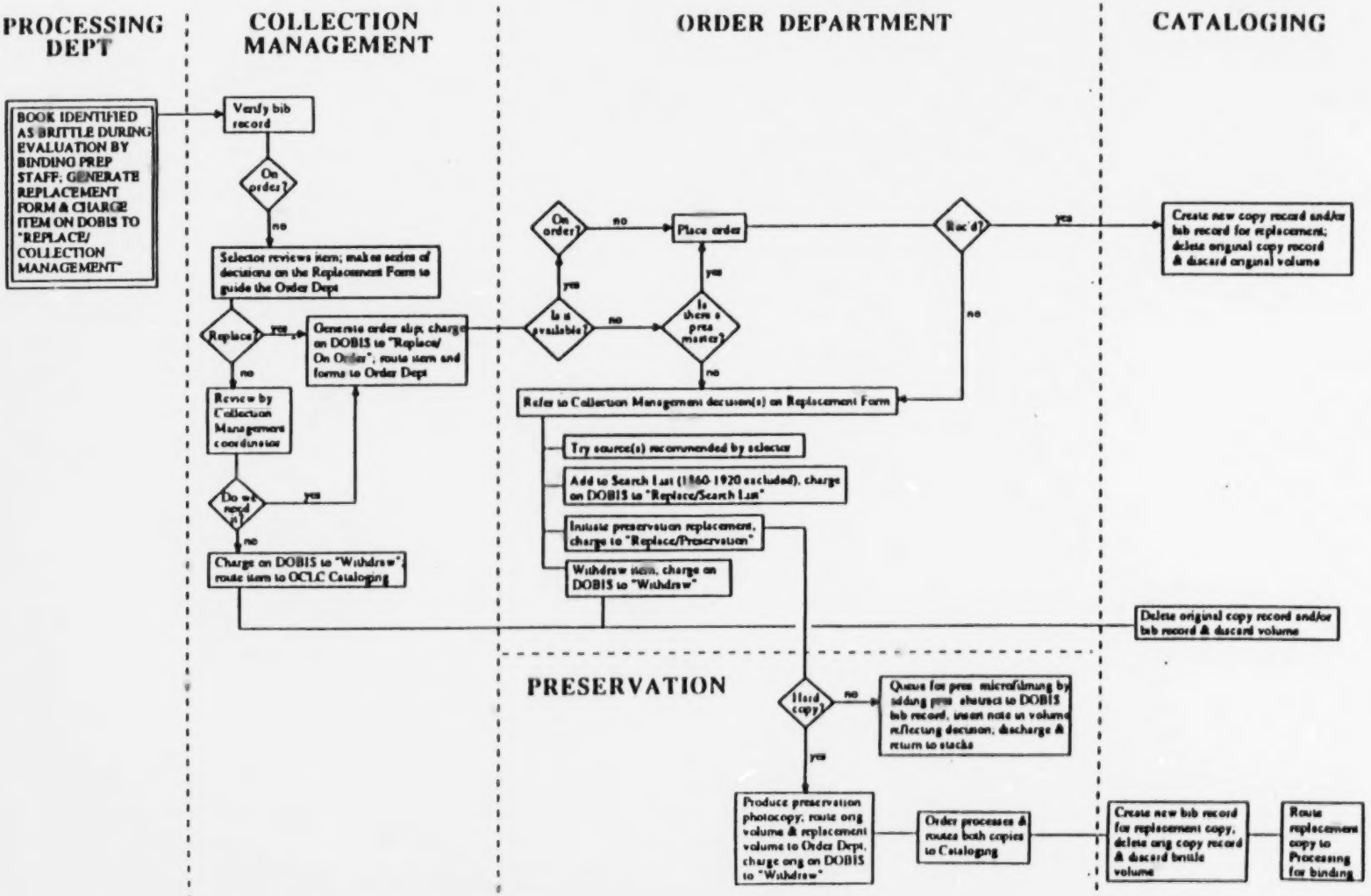
Emory University General Libraries. "Replacement for Brittle Items," in "Brittle Books Programs," *SPEC Kit 152.* Washington, DC: Association of Research Libraries, Office of Management Services, March 1989, p. 53.

Gwinn, Nancy E., ed. "Preservation Decision Flow Chart," in *Preservation Microfilming: A Guide for Librarians and Archivists.* Chicago, IL: American Library Association, 1987, p.39.

"Preservation Workflow for a Worn, Damaged, or Deteriorated Book in the Research Collections." Harvard University Library Preservation Office, March, 1992.

REPLACEMENT FOR BRITTLE ITEMS

Emory University
General Libraries
DRAFT PROCEDURE
rev 11/2/88


PROCESSING DEPT
COLLECTION MANAGEMENT
ORDER DEPARTMENT
CATALOGING
BOOK IDENTIFIED AS BRITTLE DURING EVALUATION BY BINDING PREP STAFF. GENERATE REPLACEMENT FORM & CHARGE ITEM ON DOBIS TO "REPLACE/ COLLECTION MANAGEMENT"
Verify bib record
On order?
no
Selector reviews item; makes series of decisions on the Replacement Form to guide the Order Dept
Replace?
yes
no
Generate order slip; charge on DOBIS to "Replace/ On Order"; route item and forms to Order Dept
Review by Collection Management coordinator
Do we need it?
yes
no
Charge on DOBIS to "Withdraw"; route item to OCLC Cataloging
On order?
no
yes
Place order
Is it available?
no
yes
Is there a pres master?
yes
no
Refer to Collection Management decision(s) on Replacement Form
Try source(s) recommended by selector
Add to Search List (1860-1920 excluded), charge on DOBIS to "Replace/Search List"
Institute preservation replacement, charge to "Replace/Preservation"
Withdraw item, charge on DOBIS to "Withdraw"
Rec'd?
yes
no
Create new copy record and/or bib record for replacement; delete original copy record & discard original volume
Delete original copy record and/or bib record & discard volume
PRESERVATION
Hard copy?
no
yes
Queue for pres. microfilming by adding pres. shelves to DOBIS bib record, insert note in volume reflecting decision, discharge & return to stacks
Produce preservation photocopy; route orig volume & replacement volume to Order Dept, charge orig on DOBIS to "Withdraw"
Order processes & routes both copies to Cataloging
Create new bib record for replacement copy, delete orig copy record & discard brittle volume
Route replacement copy to Processing for binding

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From: Association of Research Libraries-Office of Management Services. "Brittle Books Programs." SPEC Kit #152, March, 1989.

From:
Association of Research Libraries-Office of Management Services. "Brittle Books Programs." SPEC Kit #152, March, 1989.

YALE UNIVERSITY LIBRARIES

Preservation Decision-Making
A Descriptive Model

The Preservation Division is responsible for the preservation of materials or their intellectual content in the research collections. Titles handled by this Division are identified primarily through the Circulation process. Materials returned from circulation with physical problems or those screened out at the point of circulation are sent to the Division several times a week. Division staff screen these materials for any that may be sent to a library binder; the rest are charged out to the Division, are searched, decided upon, and processed, all to provide either the books or the reformatted information back to the readers as soon as possible. While the books are in the Division, readers have continuous access to these high-use titles, and agreements are made from time to time to allow items to be used within the building at night or on weekends and, in very unusual circumstances, to be taken out briefly for a specific purpose.

The Options

A deteriorated book from the Yale collections represents only a small part of the information needed to make an educated decision about that book in relation to the rest of the collections and the larger academic context. At least ten options exist at present with regard to any book in the system, and it is the subject specialist's responsibility to make the most appropriate decision to deal with the physical problems associated with that book while still maintaining sufficient access to the information contained within the text and, in many cases, the original item (to retain its binding, marginalia, decorations, bibliographic make-up, clues to its printing, and so on). The ten options available to the subject specialist are the following:

1. Replacement with a commercially available reprint or new edition.
2. Replacement with a commercially available microform (usually with the same edition).
3. Reproduction and subsequent replacement with a preservation photocopy produced in-house by Preservation.
4. Reproduction and subsequent replacement with a microfilm produced in-house in the Microfilming Unit.
5. Withdrawal from the collection without replacement.
6. Transfer to another collection within the system.
7. Commercial binding/rebinding by an external binder.
8. Minor repair or placement in a wrap-around or new storage container, usually by Conservation.
9. Major repair by Conservation.
10. Reshelve as is.

The variations on these ten options include retaining the original volume with any of the decisions #1-4 and either sending it to a collection with restricted use or adding the replacement and maintaining the original tied up or in a wraparound for as long as possible.

The Search

The information gathered during the search phase to facilitate deci-

sion-making on each item includes the following:

From the Card Catalog Search:

1. The correct catalog entry if this is not available from the title-page of the book in hand.
2. The dates of the author so that posthumous editions may be identified if necessary.
3. Whether or not there are other titles by this author.
4. Whether there are collected works by this author that include the individual title in hand.
5. Whether there are other editions of this work held in the Yale system; if so, their locations, call numbers, dates of publication, numbers of volumes, and differences from the work in hand (i.e., edition numbers, illustrators if the one in hand is an illustrated work, and imprint information).

From the Bibliography Search:

1. Whether or not this exact edition has been reprinted; if so, all the ordering information is noted—if not, other editions with their ordering information are listed. Sources checked include Guide to Reprints, Books in Print, Books on Demand, Forthcoming Books if need be, and the national trade bibliographies for the appropriate countries.
2. If the work is not available in hard copy, information concerning microforms is obtained with their ordering specifics. Sources checked include Guide to Microforms in Print, Serials in Microfilm, National Register of Microform Masters, the New York Public Negative Master shelflist on fiche, and the RLG Union Catalog of Microform Masters on fiche.

From the Stack Check:

1. The physical condition is noted of all other editions, volumes, and/or copies of the title; those that are in poor condition are pulled, charged, and placed with the one in hand.
2. A scholarly edition in good shape may also be pulled to show an example of what would remain if any of the deteriorated editions were withdrawn.

From the Review Session:

1. Information from the book in hand that is apparent to the subject specialist, including such things as the use according to the date due slip at the back, the extent of the deterioration based largely on paper quality (folding a corner of the paper might be used as a test), the size of the work, and those areas where the expertise of the subject specialist is exercised, e.g., the importance of the author and this work to the collection and to the scholarly community, and whether this particular edition is of special significance (including the significance of any illustrations, notes, marginalia, ownership marks, the printer, maps, binding, and so on).
2. Cost of the in-house reproduction options from the Preservation staff member aiding in the review; time estimates.
3. Whether repair is appropriate and the difficulties and general cost estimates for that repair from the Preservation staff.
4. A brief, general discussion of options possible, usually initiated by the subject specialist.

Considerations in Making Decisions

The decision must take into account the following considerations:

1. The quality of the paper, whether brittle or flexible.
2. The relationship of the deteriorated items to the rest of the Library's holdings of that title (is it the first? most recent? are all its contents contained in other editions? does it have unique information/illustrations of importance to the collection? is another copy held in the rare book collection?).
3. Is the item valuable/rare/scarce/unique/significant enough, even though deteriorated, to merit offering to a rare book collection?
4. Whether the item must be retained at all or may be withdrawn outright.
5. If it is to be withdrawn, is the library book sale an acceptable disposal route or is the item worthwhile enough to be offered to a dealer?
6. If to be retained, should the item be maintained in the original format (given the cost for the appropriate repair for that item) or replaced to retain the intellectual content only?
7. If to be maintained in the original format, does it deserve a full repair or a minor repair/wrap-around protection (i.e., how valuable is it and what would be a reasonable limit to place on repair costs? This question is obviously tied together with the paper quality; the more brittle the paper, the more valuable the item must be to justify full repair and maintenance as an object.)
8. If it may be replaced, should the item be maintained in hard copy or replaced in microform?
9. If it is to be retained in hard copy, is a reprint available and, if so, is it an acceptable reprint/edition? (Some reprinters are to be avoided; sometimes newer editions are acceptable replacements for older but undistinguished editions.) Is the price reasonable?
10. If an acceptable reprint is not available, is a preservation photocopy acceptable? (Would loose plates resulting from in-house reproduction require the new work to be cataloged for Zeta? Is the quality of reproduced illustrations acceptable? Will the page size work with photocopying?)
11. If the work may be replaced with a microform, is one available commercially of the same edition? Would another edition suffice? Is the format of the microform acceptable for Yale Microtext equipment and our standards? Is the price reasonable?
12. If a commercially available microform is not available, is the cost of an in-house microfilm acceptable?

Underlying Assumptions

The following assumptions underlie these decisions:

1. A decision should be made on an entire title at once to avoid duplication of searching effort when other deteriorated editions are used and then sent to Preservation.
2. The subject specialist should attempt to make a permanent decision whenever possible so that the same deteriorated items do not keep reappearing in yet worse condition (and finally as fragments on the floor).
3. Unique information is generally maintained in the collection.

4. Items valuable primarily as objects should be protected from use when they become deteriorated, either by transfer to a rare book collection or by restricting use in a locked cage area.
5. The quality of the paper is of paramount importance when deciding whether a volume may be repaired or not.
6. Microform replacement is often acceptable for deteriorated newspapers originally published on newsprint paper, unillustrated periodicals, long runs of published government documents, and little-used materials in all fields.
7. There are many reasons for retaining library materials in their original format, and the considerations listed in the RLG "Book as Object" document, immediately following this paper, should be kept in mind when making decisions.

Option Implementation

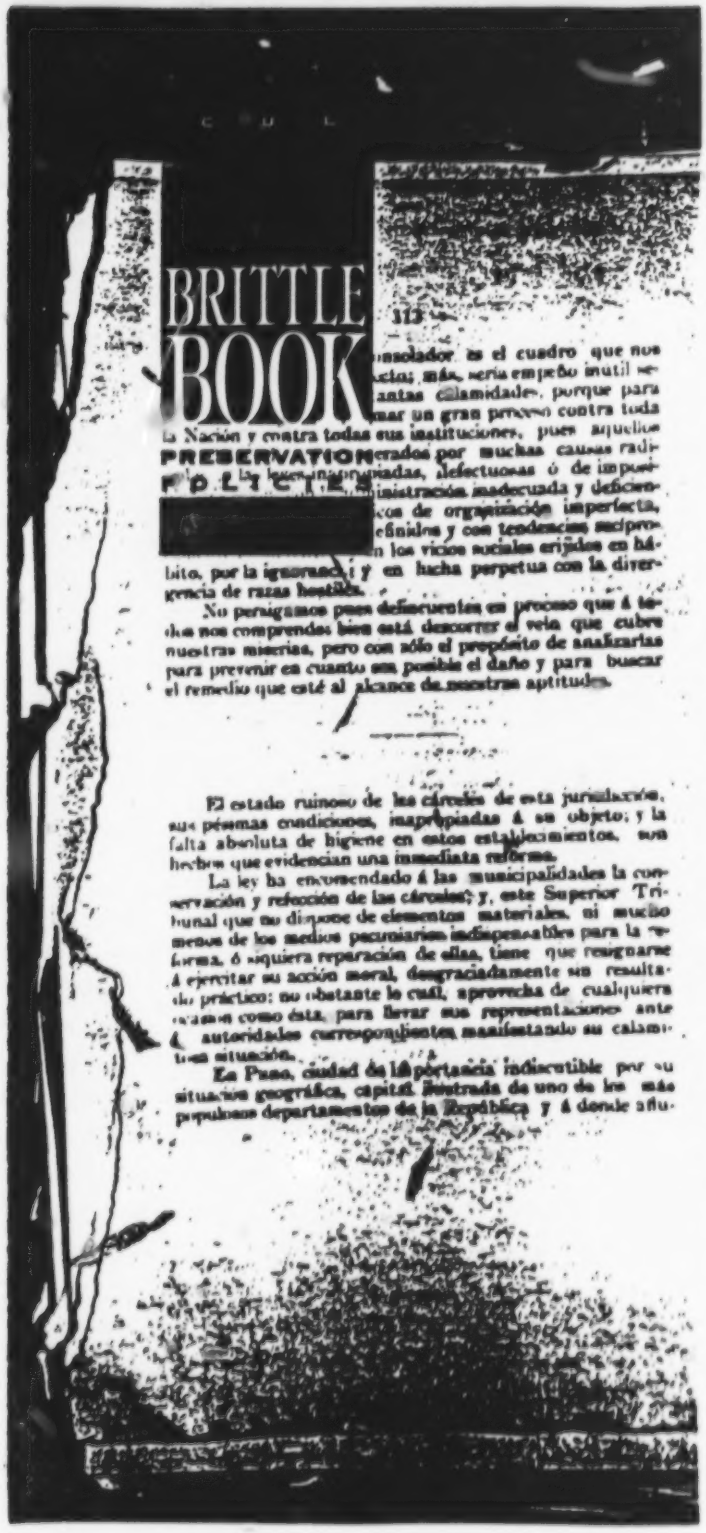
After decision-making, the option chosen is carried out by the Preservation Division personnel. Those options entail the following:

1. Replacement by commercially-available reprint or microform: original volumes are placed on the "Replacement Shelves" in Preservation; cost estimates are obtained where necessary (this may entail checking with the subject specialist when the price is known); order cards are typed marking all the appropriate boxes, including an indication of the fund account; order cards are checked on the IPL to ensure that no other order has been placed that does not yet appear in the card catalog; expensive orders (over $500) are annotated as to the rationale for the order; completed orders are sent to the Head of Collection Development for review, checked with the Library Director where necessary, and sent on to the Head of Acquisitions for placement; cataloged reprints received are compared against the originals to ensure the presence of all information/illustrations (microforms of exactly the same item are not checked); volumes being replaced are discarded by removing or marking out ownership marks and date due slips and by stamping each with a "discard" note before their trasfer to the Gifts and Exchanges unit; each shelf list card, which should have been bounced upon the cataloging of the reprint/microform, is checked approximately six months later and again in a year, when it is pulled, annotated, and sent to Cataloging if it is still there.
2. Reproduction by in-house preservation photocopy: books are placed on the photocopy shelves (rush items would be placed on special shelves for immediate copying); books with an opening measuring more than 9" from one outer text margin to the other are photocopied double-sided on acidfree paper with a binding margin and a bottom trim margin so that the final product shows normal pagination; books measuring less than 9" between the outer text margins of an opening are copied single-sided, two pages at a time, so that the binding margin is along the top edge with trim margins to left and right; the copies are collated twice, once by the photocopy machine operator and once by another staff member to ensure accurate positioning and perfect pagination; photocopies are sent out to a commercial library binder to be double-fan adhesive bound with a large enough margin to allow future photocopying; bound photocopies are sent to the shelves labeled with the original call number, the original is withdrawn (unless it goes to another collection or is maintained for some reason), and the cards

are not changed or annotated unless the book is a transfer from CCL or needs recataloging for some other reason.

3. Reproduction by in-house microfilming: books are prepared for filming by inserting a photocopied copy of its catalog card for filming, by checking it for completeness and other problems (e.g., pencil marks within the text area are erased), and by including instructions as to whether it may be cut or not; the book is filmed and returned with both the master negative and the positive service film copy (a page-by-page check of all such titles filmed is about to be instituted that will complement the bibliographic/technical inspection now carried out); the film with the card copies and the information about title sequence on the reel is sent to the Microform Coordinator for cataloging; the originals are withdrawn (or transferred/retained if the subject specialist so directed).
4. Withdrawal: the items have all ownership marks removed or marked out and a "discard" stamp applied to the inside front flyleaf and the inside back cover as well as the title page; the shelflist card is pulled and sent to the Card Processing Unit for removal of the complete set; items are sent to the Gifts and Exchanges Unit when a truckload has accumulated.
5. Transfer to another collection: items recommended for transfer to another collection usually require a note requesting permission to be sent to the Deputy University Librarian; upon receipt of this permission, the item is sent to the correct cataloging unit for the change of records. The Beinecke Library bibliographer review books regularly and transfer many directly there.
6. Commercial binding/rebinding: books identified for library binding are charged and sent directly to the Preparations Division for processing; barcodes are removed and retained with the charge record in the Preservation Division and readhered upon receipt of the bound volume.
7. Minor repairs or wrap-arounds: items requiring only minor repairs or wrap-arounds are so marked, charged in, and placed on the Conservation shelves (some tip-ins are done by Preservation personnel).
8. Major repairs: items requiring major repairs are so marked and placed on the Conservation shelves for their selection.
9. Reshelve as is: these may include items with cosmetic damage only; a record for it may or may not be kept on it for future examination.

RGW 4/86
Preservation Dept.
Yale University



THE COLUMBIA UNIVERSITY LIBRARIES

is strongly committed to the preservation of its books and journals, so that it can continue to provide access to a useful, scholarly research collection for the Columbia University community. While it is our good fortune to have such a distinguished, in-depth retrospective collection, it is also true that many of these valuable, often irreplaceable materials are crumbling on our shelves.

It is well known that from about the 1850s paper has been manufactured through processes that leave an acidic content. The acid gradually breaks down the cellulose fibers of which paper is composed. With sufficient time, especially in conditions of high humidity, high temperature, and polluted air, the paper becomes so brittle that it breaks when folded. We in New York are particularly hampered by our environment, and our collections have suffered more than those in many other parts of the country.

Over the past twenty years, research and academic librarians have worked with conservators, scientists, and micrographics experts on technologies to address these problems. At the same time they have developed policies and principles to guide the application of these technologies. No one technology solves all problems. Libraries such as Columbia have adopted a comprehensive approach that carefully matches the appropriate treatment to the damaged book.

The preservation of embrittled materials poses a significant challenge because paper that breaks when folded cannot withstand the manipulation needed for rebinding or normal

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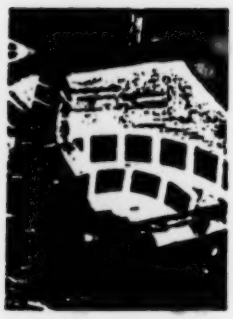
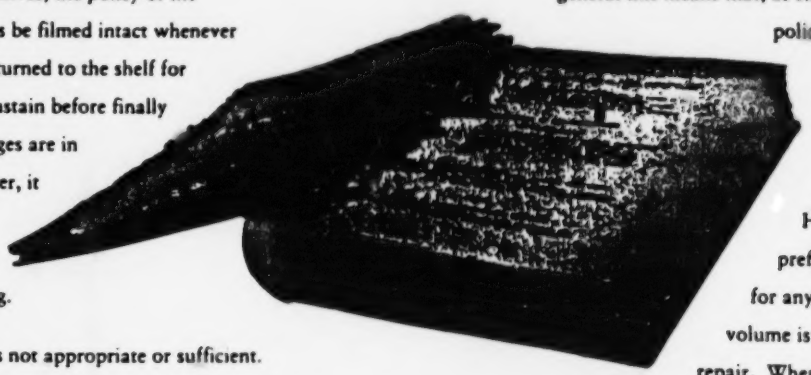
repairs. This means that a book whose pages have begun to break cannot be put back together again except by extremely costly page-by-page conservation treatment — and in many cases even this is not possible. The monetary value of most volumes in the Columbia University collections does not justify spending hundreds of dollars per volume for repair, although we do have rare materials for which such costly conservation is fully warranted.



For most books that are too brittle to be repaired with routine methods, the most appropriate preservation technique is to purchase a reprint or, if none is available, to turn to microfilm to preserve at least the text of the volume (its "intellectual content") if not its physical manifestation. The master negative of the film is stored under archival conditions to assure a lifespan of several hundred years for the content of the volume, while new positive copies can be produced on demand.

As for the brittle volumes themselves, the policy of the Libraries mandates that volumes be filmed intact whenever possible, so that they may be returned to the shelf for whatever further use they can sustain before finally disintegrating. If a volume's pages are in pieces before it is filmed, however, it is already beyond further use and is normally withdrawn from the collections after filming.



Sometimes microfilming alone is not appropriate or sufficient. In the case of volumes with color plates or unusual bindings, or in the case of heavily used reference works, more expensive methods of preservation may be employed in addition to or in lieu of microfilming. Color plates may be manually deacidified and encapsulated in clear inert plastic film to allow continued use. A volume with a significant binding may be placed in a custom-fitted box after filming to protect it for as long as possible, while a heavily used reference tool might be photocopied onto acid-free paper rather than being filmed.

Preservation photocopies are of value in providing paper substitutes for brittle books, especially those that receive heavy use or that are not well suited to microformat. Unlike preservation microfilm, however, a preservation photocopy does not provide a master that can be archivally stored for hundreds of years and used to produce additional copies on demand.

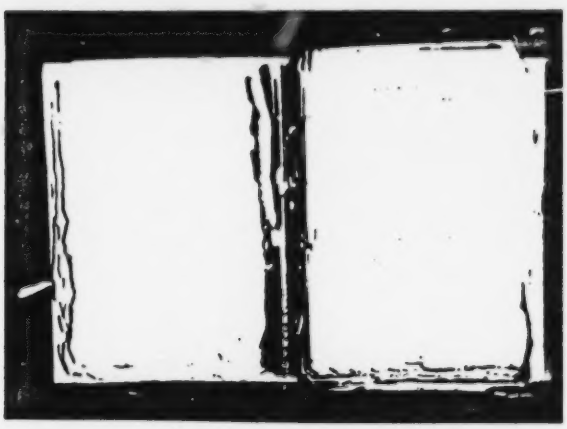
The decision on how to preserve each brittle, unrepairable volume is made by the bibliographer responsible for its subject area, in consultation with staff from the Libraries' Preservation Division. When appropriate, the bibliographer also consults with relevant faculty members. Every effort is made to ensure that the most suitable preservation method is applied. In general this means that, as stated in the policies appended to the Columbia University Libraries Preservation Handbook, the preferred treatment for any damaged volume is rebinding or repair. When a volume is structurally unsound and too brittle to repair, the Libraries

(continued from inside)

will try to locate a non-brittle paper copy, reprint, or later edition. Microfilm is normally the last alternative.

Identification of brittle volumes involves library staff, faculty, and other library patrons. Pulic service staff of all the Columbia libraries screen volumes returned by patrons to find endangered items. Library patrons who use damaged volumes bring them to the attention of the library staff. Concerned faculty are encouraged to discuss endangered parts of the collections with librarians. When special grant funding is available librarians work with the faculty to identify areas of particular importance for concentrated preservation activity, and collaborate with existing or specially-created faculty advisory groups on large preservation projects. The amount of preservation work needed by the collections is almost overwhelming, and requires participation from all of the Columbia community.

New and developing technologies promise a brighter future for our collections. Increasingly, US and Western European scholarly volumes are being printed on acid-free paper with a much longer life than the acidic paper to which we are unfortunately accustomed. Processes for mass deacidification, which will help reduce the speed of embrittlement of new acidic volumes by chemically neutralizing the acid content, should become available and affordable within the next few years.



For already embrittled volumes, new digital and optical scanning technologies now under development offer hope for an alternative to microfilm. Research into the life spans of these media is currently ongoing — after all, transferring the content of brittle books to new media that will themselves deteriorate in five or ten years is not a solution to the problem. Pilot projects to develop accurate and cost-effective methods for scanning and digitizing both brittle books and microfilm are now underway at several institutions.

In the meantime, microfilm remains the time-tested method for preserving the content of brittle books that cannot be repaired. It is an excellent means of disseminating to a wide audience materials endangered by or difficult to use in the original, and its simple technology makes it accessible internationally, even in underdeveloped areas.

The Columbia University Libraries will continue its current policy of providing the most suitable treatment for each volume, and looks forward to employing new technologies as they become available.

Interested Columbia faculty are welcome to tour the Preservation Division. Appointments may be made by calling 854-5757.

Columbia University Libraries
Preservation Division

9/91

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COLUMBIA UNIVERSITY LIBRARIES

PRESERVATION DEPARTMENT

THE PRESERVATION OF LIBRARY MATERIALS:

A CUL HANDBOOK

GUIDELINES AND PROCEDURES

5th Edition

1991

SECTION 6.0 REPLACEMENT/REFORMATTING OPTIONS FOR BRITTLE AND MISSING MATERIALS

Replacement or reformatting (creation of a copy of the item in another format, normally microform or photocopy) should be considered when the original material is too brittle or otherwise deteriorated for physical treatment, or when the item is missing. Replacement/reformatting is the only practical and economical long term treatment option available for the majority of brittle, damaged materials in the general collections.

Replacements can be reproductions of exact editions, or editions that include or supersede a work, in hard copy (reprint, photocopy) or microform. They can be purchased from commercial sources or created on demand. The selection of the appropriate replacement will depend on a number of variables, primarily availability, cost, and specific collection needs and priorities.

The following sections contain descriptions of the types of replacements that are commercially available (reprints and microforms) and of those that can be created through inhouse services or outside vendors (microforms and photocopies). Descriptions include the major characteristics of each replacement format, information on how to choose a format, materials suitable for each format, and guidelines for locating available replacements or for requesting the creation of replacements.

6.1 Commercial Reprints and Microforms

Reprints and microform replacements of missing or out-of-print materials are often available from commercial publishers and library photoduplication services. The purchase of an existing replacement is frequently the most economical option. Titles needing replacement should be searched thoroughly to locate existing replacements. Replacement catalogs for reprints and microforms are available in Butler Reference; microform replacement catalogs are also available in the Preservation Division.

Paper Reprints

Volumes for course reserve, heavily circulated material, reference works, and volumes with color illustrations or maps may not be appropriate for microform replacement. Paper reprints are usually the preferred replacement choice in any case for monographs, pamphlets, and short series.

With few exceptions, a reprint should be selected in preference to a copy from the out-of-print market. If a CUL volume has embrittled with age, another copy published at the same time will usually be just as fragile and will

deteriorate as quickly once it is subject to use. Selectors should make a conscious effort not to add to the future preservation problems of the Libraries and should avoid materials that need treatment before they can be placed on the shelf for the first time.

Microforms

Microforms are the second replacement choice. Many titles are widely available in microform from commercial and library sources, usually at a cost competitve with paper reprints. In many cases a microform may be the only available replacement, especially for a serial title. Half-tone illustrations, uncolored maps, photographs, and plates reproduce adequately, making microforms suitable to replace most library materials when preservation of the intellectual content is the primary objective.

Micropublishers offer a variety of choices: 35mm roll film or microfiche; positive or negative polarity; emulsion of silver gelatin (also called silver halide), vesicular or diazo. (While 16mm film is available, its use is discouraged, and most libraries do not have 16mm readers.) Libraries with microfilming facilities often provide only silver gelatin 35mm roll film. If the publisher offers a choice, select the most useful format based on your library's reading and printing equipment, your storage capacities, the formats already in the collection, and the format that best suits the type of material and its use. An index or catalog for quick reference is better suited to fiche, a thin or average volume is reasonable in either fiche or film, and a serial is best suited to a roll film format. On the one hand, microfiche is a little easier to use and patrons tend to prefer it. On the other hand, microfilm may cause fewer security and reshelving problems.

As a general rule, positive service copies should be purchased for use in the library. Select negative polarity film only if the principal use will be on a reader-printer with reverse polarity: when making a paper print from a positive microform (black writing on white paper), the paper print will be a negative image (white writing on a black background). Service copies need not be silver gelatin. When a publisher offers a choice, vesicular or diazo films usually cost less and are more durable under use conditions.

NOTE: The three types of emulsion (silver gelatin, vesicular, and diazo) are best stored separately, because in close proximity they can cause chemical reactions in each other. If possible, either purchase one type of emulsion consistently, or else establish separate storage for the three types.

Retention of Original Volumes

Original material that must be retained because of artifactual value can often be filmed without disbinding. This is particularly true for older materials

(pre-1850) with good, flexible paper and reasonable inner margins. If paper is brittle, a microfilm copy can serve as a protective measure by its use in place of a fragile original. This works most successfully when use of original material can be restricted. If it is necessary to retain the original, and it cannot be filmed without damage, Preservation will contact the selector to discuss options.

It is CUL policy to film all volumes intact when physically possible, but some volumes are so brittle and so damaged that they cannot survive filming. Intact volumes are returned to the library for patron use until they become unusable, while volumes which break up during filming are normally withdrawn immediately. HOWEVER, it is ultimately the choice of the selector whether to retain or withdraw a volume after filming. The Missing/Brittle Worksheet (D115) includes a checkoff for retain or withdraw, and Preservation will follow the instructions of the selector.

6.2 Preservation Filming – General Overview

The Preservation Reformatting Office (PRO) in the Preservation Division is the unit responsible for processing microfilming recommendations. Using the D115, recommendations should be sent directly to PRO on a regular basis as titles are identified. Preservation Division staff are also available to discuss large or special microfilming projects.

Titles recommended for CUL filming should be:

- of significant research value to the collection;
- printed on paper that is becoming so brittle and deteriorated that the item cannot be used without causing damage;
- normally not of great artifactual value, since the original might be damaged during filming;
- unavailable in reprint or microform. Preservation will not duplicate filming already done unless exisiting film is flawed in some manner;
- as complete a bibliographic unit as possible. PRO will attempt to borrow in order to replace limited numbers of missing pages or serial issues, but CUL should have reasonably complete holdings over a span of time. Volumes may be rejected as microfilming candidates if they are too damaged or incomplete.

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The Commission on Preservation and Access

Providing Access To The Accumulated Human Record As Far Into The Future As Possible

Newsletter

NUMBER 50 OCTOBER 1992

Cornell, Yale Advance with Digital Technologies

Cornell and Yale Universities have released reports on their explorations of the interinstitutional use of digital technologies to preserve and enhance access to deteriorating scholarly works of national and international importance. The two reports describe work conducted under contract to the Commission as part of an initial phase of an evolving digital preservation consortium.

Participation convinced Cornell of the value of digital technology to preserve and make available research library material.

The Cornell report on Phase I (January 1990 - December 1991) of the university's Joint Study in Digital Preservation — Digital Capture, Paper Facsimiles, and Network Access describes the collaborative efforts of Cornell and the Xerox Corporation to capture the contents of 1,000 brittle books as digital images and to produce printed paper facsimiles. Of equal interest is the role of digital technology in providing networked access to library resources. Participation in the joint study convinced Cornell of the value of digital technology to preserve and make available research library material. Principal conclusions are:

1. Digital image technology provides an alternative — of comparable quality and lower cost — to photocopying for preserving deteriorating library materials.

2. Subject to the resolution of certain problems, digital scanning technology offers a cost effective adjunct or alternative to microfilm preservation.

3. Digital technology has the potential to enhance access to library materials.

4. Through the implementation of document control structures, digital technology offers a means to facilitate access and to provide links between the library catalog and the material itself.

5. The infrastructure developed for library preservation and access activities supports other applications in the electronic dissemination of information.

Yale's new report narrates the organizational phase of Project Open Book, the university's effort to convert 10,000 volumes in microfilm format into digital image form and to explore the effects of scale on emerging preservation imaging systems. The master plan for this project was first detailed in the June 1991 report, *From Microfilm to Digital Imagery*. In the organizational phase, Yale has established the internal project team and steering committee; identified the required hardware, software, services and staff; established costs and developed a budget; and selected a vendor partner. Two remaining objectives are to identify criteria for selecting the materials for conversion and to raise the necessary funds to support subsequent project phases. The report concludes:

Yale recognizes the need to find collaborative ways to address . . . the use of digital image technology.

Continued on p. 2

Cornell & Yale

Continued from p. 1

As work proceeds to the next phases in Project Open Book, Yale recognizes the need in the library community to find collaborative ways to address the key issues raised by the use of digital image technology. In particular, it needs to build a technical and organizational infrastructure of equipment, software, networks, and knowledgeable users and staff that spans multiple campuses and facilitates the reliable and cost-effective interchange of image documents.

• • •

These digital preservation projects are being conducted under contract to the Commission with funding from The Andrew W. Mellon Foundation, which also is supporting distribution of the new reports to the Commission's mailing list. Additional copies are available while supplies last, with prepayment by check (U.S. funds only) required. Please refer to complete title when ordering. Commission sponsors receive all publications at no charge.

The Joint Study in Digital Preservation. Report Phase I (January 1990 - December 1991) Digital Capture, Paper Facsimiles, and Network Access. by Anne R. Kenney and Lynne K. Personius. Cornell University, 47 pages, $10.00.

The Organizational Phase of Project Open Book: On the status of an effort to convert microfilm to digital imagery: a report of the Yale University Library to the Commission on Preservation and Access, by Donald Waters and Shari Weaver. July 1992. 11 pages. $5.00.

[Earlier report on Open Book]
From Microfilm to Digital Imagery: A Report of the Yale University Library: June 1991. 41 pages. $5.00.

1400 16th Street, N.W., Suite 740 • Washington, D.C. 20036-2217 • Telephone: 202/939-3400 • FAX: 202/939-3407

SPECIAL REPORT

Research on the Use of Color Microfilm

Research projects sponsored by The Getty Grant Program on the suitability of color microfilm for preservation have submitted final reports after two years of investigation and experimentation (see January 1992 and May 1992 newsletters). The research is closely related to the work of the Joint Task Force on Text and Image, also sponsored by The Getty Grant Program, whose final report, ***Preserving the Illustrated Text***, was published by the Commission in May 1992. The Commission contracted with the Image Permanence Institute (IPI) and MAPS The MicrogrAphic Preservation Service, Inc., to conduct research and demonstration projects to aid the field of art history in establishing a comprehensive approach to preservation. The substantive content of the final reports follows, since the Commission will not be distributing the complete reports. Information on specific aspects of the research is available from James Reilly, IPI, Rochester Institute of Technology, Frank E. Gannett Memorial Bldg., P.O. Box 9887, Rochester, NY 14623-0887 and Lee Jones, MAPS, Nine S. Commerce Way, Bethlehem, PA 18017.

IPI: Color Microfilm Dark Stability

Project Summary

The project "Permanence of Color Microforms for Library Preservation" was a two-year study to explore the comparative dye stabilities of chromogenic and silver dye bleach (SDB) microforms. In addition to dye fading, the physical properties of the gelatin emulsions and film supports were also studied. The permanence of color microforms is a concern in the library community because a large segment of embrittled library material cannot be adequately preserved by simple black-and-white microfilming. For any original book, map, art reproduction or manuscript in which color is an integral part of the information content, there must be a way to preserve the color component of the image.

Although manufacturers of both SDB and chromogenic film provide dye stability information for their products, this project is the first that integrates an examination of dye, gelatin and film support stabilities. For most of the measured properties it was possible to use a mathematical model known as the Arrhenius Relationship to predict the behavior of dyes, gelation emulsions and plastic supports under typical storage conditions.

Incubations were carried out at both 50% and 15% RH in order to determine the humidity sensitivity of the various microfilms. It is generally known that lower humidity will benefit the life of dyes, gelatin and plastic supports, but the degree of benefit is less know.

Materials tested in this project proved to be surprisingly stable. As a result, although the basic requirements of the project were met, data collection is expected to continue for several more years.

Key Project Results

1. Color microfilming is a viable preservation method. Even at room temperature, it is possible to preserve master color microform images as long as 100 years.

2. Overall, at room temperature and moderate RH conditions, Cibachrome SDB films exhibit superior permanence to chromogenic microfilms.

3. In the accelerated aging studies, films sealed in bags had a shorter life than films free-hung in the chambers. This is likely due to harmful degradation byproducts being trapped in the sealed bags and accelerating deterioration. Unfortunately, the bagged film tends to reflect more closely how film is stored in real life than open, free-hung film does.

4. Insufficient data is available to make predictions regarding the dark stability of Cibachrome dyes. However, one could reasonably expect two to three centuries to pass before significant dye fading occurs under room temperature and moderate RH storage conditions.

5. The dark stability of Cibachrome dyes is far superior to chromogenic dyes.

6. While the polyester support of Cibachrome films may not be as stable as some other polyester bases, it is still at least as stable as triacetate.

7. Predictions for the future physical properties of Cibachrome film gelatin emulsions were notably shorter than for chromogenic film emulsions. However, Cibachrome emulsions can be expected to remain in usable condition for at least 200 years at room temperature and moderate RH conditions.

Table 1
Summary of Dye Stability Properties

Film Type	Time in years for 30% Loss of Least Stable Dye	Least Stable Dye
Cibachrome CMM	200 - 300 (estimated)	-
Cibachrome CMP	200 - 300 (estimated)	-
Eastman 5243	25	Cyan
Eastman 5272	25	Cyan
Eastman 5384	40	Yellow

Dye predictions made at 24°C in accordance with ANSI IT9.9-1990

Table I shows the predicted or estimated time in years before each microfilm loses 30% of its most fugitive dye at room temperature and 50% RH. Which of the three dyes (cyan, magenta, or yellow) is the least stable dye is indicated. The Cibachrome film did not reach the desired 30% dye loss, thus values for these films have been estimated and the least stable dye could not be predicted.

Table 2
Summary of Emulsion Mushiness Properties

Film Type	Years to Reach 50 Gram Mushiness
Cibachrome CMM	100
Cibachrome CMP	100
Eastman 5243	500
Eastman 5272	500
Eastman 5384	800

Mushiness predictions made at 20°C

Table II contains predictions in years for the gelatin emulsion on each of the films to reach a mushiness value of 50 grams if stored at room temperature and 50% RH. (Mushiness is a measure of how much load must be applied to a 0.007 inch sapphire stylus to break though a wet gelatin emulsion.) Fifty grams does not necessarily represent the point at which the film is no longer useable; it is a very conservative minimum estimate of the useful life.

Table 3
Summary of Break Stress Properties

Film Type	Years to Reach a 66% Retention of Break Stress
Cibachrome CMM	250
Cibachrome CMP	200
Eastman 5243	250
Eastman 5272	250
Eastman 5384	250

Break stress predictions made at 20°C

Table III lists the predicted number of years required for the tensile break stress of the plastic support to decrease by 33% when stored at room temperature and 50% RH. (Tensile break stress is a measure of how much force is required to break a sample of plastic film base under controlled conditions.) Such a large physical property change is an indication of serious chemical breakdown of the plastic support; however, film which retains 66% of its original tensile break stress may still be useable in practice.

General Conclusions

1. Under cold storage either chromogenic or SDB color materials can be kept for many centuries. Thus, with cold storage, either type of color microfilm can be considered "permanent".
2. With respect to the stability of image dyes, gelatin and film support, if storage conditions are likely to be at room temperature and moderate RH, there is little doubt that Cibachrome microfilm is a significantly better choice than chromogenic film. Collections using color microfilm will also have to weigh other factors before making their selection of film. With respect to sensitometry, Cibachrome film is slower and has higher contrast making it somewhat more difficult to work with. Local environmental laws may make processing Cibachrome film difficult. Finally, in the case of service and use copies of film, handling damage may nullify any longevity benefit gained by using Cibachrome. All of these problems can be dealt with in different ways and may not be problems at all.

MAPS: Color Microfilm and Continuous Tone Processing

The two parts of this contract had widely different results, but both contributed information to our understanding of the issues involved. . . .

Continuous Tone Processing (CTP)

The contract was awarded just as MAPS was taking delivery on its first Herrmann & Kraemer 16/35mm computer controlled camera . . . while the frustrations of the continuous tone processing project, detailed below, were being experienced, startlingly good results were achieved using the Herrmann and Kraemer (H&K) camera and Kodak AHU camera film on continuous tone materials. The prospects are that these results can be further improved if either a CTP technology can be implemented or a special film for continuous tone material can be found. . .

The original intent was to purchase a license from H&K and to receive instruction in implementing the process in our processing laboratory. Just as negotiations were about to be concluded with H&K, that company received several very large contracts for other work . . . subsequent discussions with H&K led us to begin testing an alternate route to successful filming of continuous tone materials. It turns out that H&K uses its own CTP technology only in the most difficult cases, cases where the subject material has a very narrow tonal range and very low contrast. They have explored the use of duplicating films as original camera films. While MAPS' efforts in this area have taken place outside of the current contract, the activity should be of interest to the Commission, the Getty Grant Program, and others interested in capture of black and white continuous tone material for preservation purposes.

Initial tests were frustrating indeed, since no images at all were captured using Kodak duplicating film in exposure ranges thought to be sufficient. . . . In order to expose duplicating film in a microfilm camera, 80 times more light must reach the film. This means that either one must increase exposure by 80 times, increase the intensity of light by 80 times, or, and more reasonably, provide the added exposure by a combination of more intense light and longer exposure times. These requirements mean that only cameras capable of adjustable exposure times and alternate light sources are capable of using duplicating film as a continuous tone filming medium. Testing is still at a very early stage, but already results are promising. There is a clear improvement in capture of continuous tone values using duplicating films as opposed to results using conventional AHU camera films. MAPS will continue testing this strategy and will be pleased to share its progress with those interested.

Thus, while making no progress on the originally proposed project, definite strides have been made in the development of a way to capture continuous tone materials with much improved fidelity on films that will qualify as preservation films.

Appendix 2

Operational Impact of Filming Projects on Library Units

Developed by Nancy E. Elkington
and Sandra Nyberg

Implementing a successful microfilming project is an intellectual and fiscal challenge affecting nearly every unit in a library. Prior to committing to such an effort, the organization's senior administration and middle management must have a clear vision of the degree of involvement required of various units as well as the implications for resource allocation priority reevaluation at the highest levels. The matrix below and the following appendix, "Considerations When Expanding Preservation Microfilming Capacity," should be studied by staff responsible for filming projects. Note that only project operations that occur outside of the preservation office are identified in the matrix.

TABLE 3. OPERATIONAL IMPACT MATRIX.

PROJECT OPERATION	AFFECTED LIBRARY UNITS	ACTIVITY
Selection	Collection Development	Identifying, reviewing content, bibliographic searching and/or collection analysis, assessing acceptability of existing replacements
	Circulation	Record-keeping, retrieval (onsite and off), returning rejected candidates to shelf, processing of withdrawals (not replaced)
	Acquisitions	Replacement searching, ordering reprint, film, commercial photocopy replacements, processing of withdrawals (not replaced)
	Cataloging	Bibliographic control of reprint, film, or photocopy replacements
	Book Repair	Providing protective enclosures if a damaged book is not selected for filming but is returned to shelf
Prepare for Filming	Cataloging	Queuing (record update), prospective cataloging (reel programming in order to assign storage numbers—impact of multiple titles on one reel, etc.)

PROJECT OPERATION	AFFECTED LIBRARY UNITS	ACTIVITY
	Interlibrary Loan	Borrowing missing material to complete a title (up to six locations per title)
	Collection Development	Making decisions about disbinding, retention after filming
Film	Circulation and/or Reference	Providing access to materials during filming process (rush basis)
	Mail Room	Shipping (and insuring) and receiving materials to and from off-site filming agent
End Processing	Cataloging	Updating queued records, bibliographic control of microfilm (local system and national), label film boxes, file catalog cards
	Circulation	Reshelving filmed materials if retained
	Microform Reading Room	Labeling boxes, providing storage for printing negatives and service copies, providing access to service copies
	Mail Room	Shipping film to off-site storage
	Collection Development	Making decisions about retention of originals, acquisition of Copyflo prints
	Cataloging, Circulation and/or Acquisitions	Processing withdrawals
	Book Repair	Providing protective enclosures if a damaged book is retained after filming
	Library Binding	Binding Copyflo prints, if needed
Overhead	All Units Mentioned Above	Developing policies and procedures; implementing project
	Personnel	Recruiting, training, handling payroll and benefits
	Purchasing	Supplying paper clips to writing, bidding out, and negotiating microfilming service contracts
	Business Office/ Admin. Services	Contracting services (payments), leasing storage space, maintaining financial records
	Systems Office	Supporting automation needs
	Senior Administration	Reporting, creating funding initiatives

Appendix 20

Authoritative Sources in Preservation Microfilming

Compiled by Nancy E. Elkington

The standards and recommended practices listed below are reviewed and revised periodically. Contact AIIM for information on the most recent standards publications. The following AIIM publications are available from Association for Information and Image Management (AIIM), 1100 Wayne Avenue, Suite 1100, Silver Spring, MD 20910:

ANSI/AIIM MS14.
Specifications for 16 mm and 35 mm Roll Microfilm. 1988.

ANSI/AIIM MS18.
Splices for Imaged Film—Dimensions and Operational Constraints. 1987.

ANSI/AIIM MS19.
Recommended Practice for Identification of Microforms. 1987.

ANSI/AIIM MS23.
Practice for Operational Procedures/Inspection and Quality Control of First-Generation, Silver-Gelatin Microfilm of Documents. 1991.

ANSI/AIIM MS26.
35 mm Planetary Cameras (top light)—Procedures for Determining Illumination Uniformity of Microfilming Engineering Drawings. 1990.

ANSI/AIIM MS34.
Dimensions for Reels Used for 16 mm and 35 mm Microfilm. 1990.

ANSI/AIIM MS45.
Recommended Practice for Inspection of Stored Silver-Gelatin Microforms for Evidence of Deterioration. 1990.

ANSI/AIIM MS48.
Recommended Practice for Microfilming Public Records on Silver-Halide Film. 1990.

TR (Technical Report) 02.
Glossary of Micrographics. [Draft *Glossary of Imaging Technology* in development—to replace 1980 edition in 1992.]

The following ANSI publications are available from the American National Standards Institute, Sales Department, 1430 Broadway, New York, New York 10018 (AIIM is also an authorized distributor of these publications):

ANSI/ISO 3334.
American National Standard for Microcopying—ISO Test Chart No. 2—Description and Use in Photographic Documentary Reproduction. 1989.*

ANSI IT9.1.
American National Standard for Imaging Media (Film)—Silver-Gelatin Type—Specifications for Stability. 1989.

ANSI IT9.2.
American National Standard for Imaging Media—Photographic Processed Films, Plates, and Papers—Filing Enclosures and Storage Containers. 1991.

ANSI IT9.5.
American National Standard for Imaging Media (Film)—Ammonia-Processed Diazo Films—Specifications for Stability. 1988.

ANSI IT9.11.
American National Standard for Photography (Film)—Safety Photographic Film. 1991.

ANSI IT9.12.
American National Standard for Photography (Film)—Processed Vesicular Film—Specifications for Stability. 1991.

ANSI PH1.43.
American National Standard for Photography (Film)—Processed Safety Film—Storage. 1985.

ANSI PH1.51.
American National Standard for Photography (Film)—Micrographic Sheet and Roll Film Dimensions. 1983.

ANSI PH4.8.
American National Standard for Photography (Chemicals)—Residual Thiosulfate and Other Chemicals in Films, Plates, and Papers—Determination and Measurement. 1985.

Additional reference publications:

Association of Research Libraries. *Guidelines for Bibliographic Records for Preservation Microform Masters.* Washington, D.C.: Association of Research Libraries, 1990.

* Also known as *ANSI/AIIM MS51-1991.*

Gwinn, Nancy, ed. *Preservation Microfilming: A Guide for Librarians and Archivists*. Chicago: American Library Association, 1987.

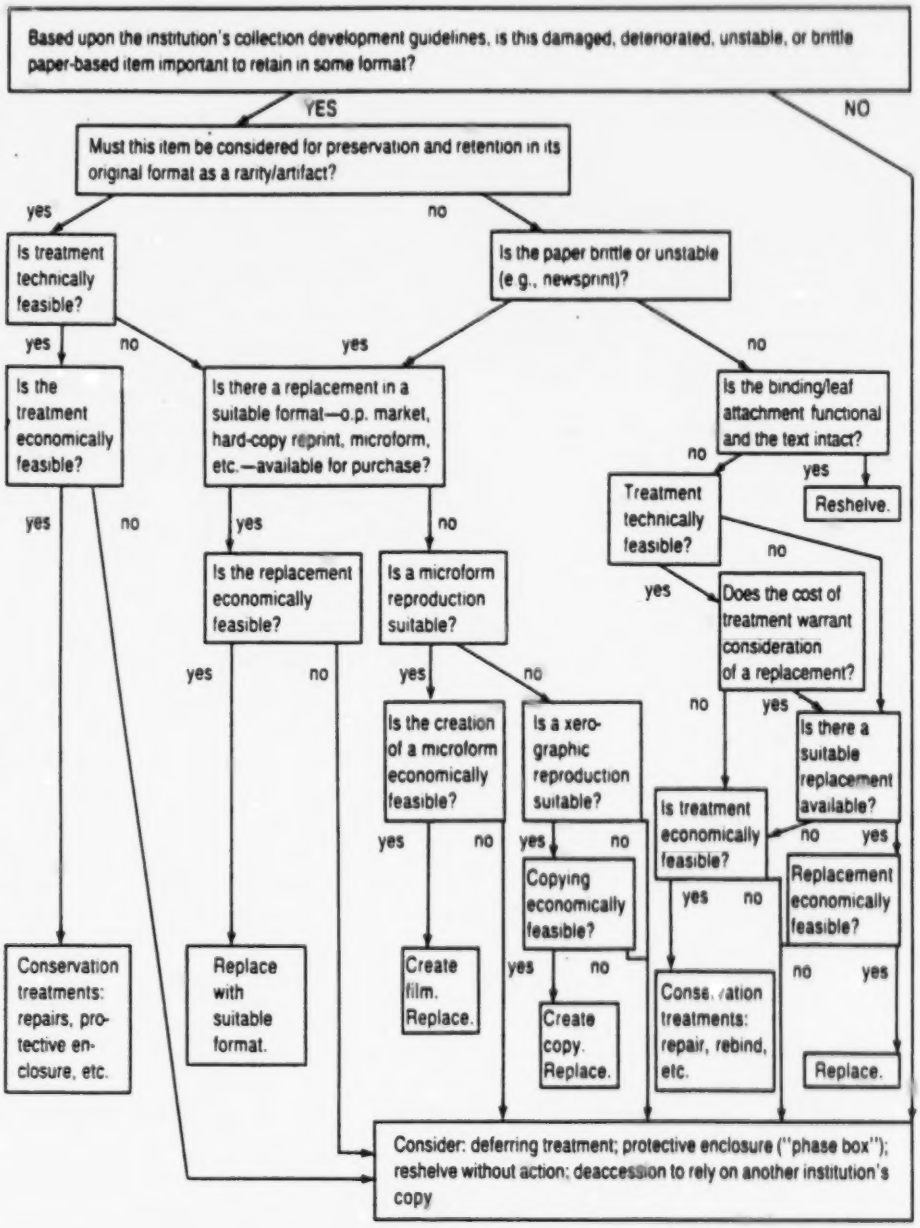
Harriman, Robert, ed. *U. S. Newspaper Program Planning Guide and Resource Notebook*. Washington, D.C.: Serial Record Division, Library of Congress, 1991.

McClung, Patti. "Costs Associated with Preservation Microfilming: Results of the Research Libraries Group Study." *Library Resources and Technical Services* 30, no. 4 (October/December 1986): 363-375.

McKern, Debra, and Sherry Byrne. *ALA Target Packet for Use in Preservation Microfilming*. Chicago: American Library Association, 1991.

From: Gwinn, N. Preservation Microfilming

Figure 2. Preservation Decision Flow Chart



SOURCE: Wesley L. Boomgaarden, Preservation Office, Ohio State University Libraries.

Appendix Two
The Acidic and Brittle Paper Problem and its Solutions[1]

In 1874, Harvard President Charles W. Eliot wrote, "the Library is the heart of the University." He could not have known that the paper manufacturers of his era, in revolutionizing the way paper was made, were unknowingly igniting the slow fires of paper deterioration. These slow fires would begin to threaten access to the "heart of the University" a mere hundred years later.

The legacy of the acid papermaking process—the acidic and brittle paper problem—is most acute for books printed between 1840 and 1950. When John Harvard bequeathed his books in 1638, paper was made from a pulp of cotton rags, beaten and formed by hand into strong, durable sheets. Although the paper in the books published in John Harvard's day remains strong and flexible, industrial age books and documents are threatened with extinction.

Papermaking Technology and its Effect on Paper Permanence

Paper was invented about 2,000 years ago in China, and spread to Europe during medieval times. Until relatively recently, Western paper was made by hand from a pulp of cotton rags. This type of paper was strong and chemically stable. A master papermaker could produce about 125 sheets of it per day.

The growing need for paper led to the development of mechanized papermaking processes in the nineteenth century. New fiber sources were also needed if supply were to match demand. Wood pulp was introduced during the 1840s as a viable alternative to cotton rags. At the same time, paper mills began to use new chemical additives, especially aluminum sulphate (commonly known as alum), to help give their products a good finish and printability.

Unfortunately, this new paper contained the seeds of its own destruction. The alum sizing combines with humidity in the air to produce sulphuric acid. Over time, this increased acidity destroys the flexibility of cellulose fibers and makes paper brittle. Other chemicals, such as the chlorine used to bleach the paper white, increase the rate of deterioration. Alum-sized acidic paper can become unusable in as few as fifty years.

Paper made from ground wood, as opposed to chemically cooked pulp, also contains lignin, a naturally-occurring substance that gives woody plants their

[1] The text of this appendix was adapted from the exhibit "Slow Fires in Harvard's Libraries," prepared by Carolyn Morrow and Elaine Benfatto of the Harvard University Library Preservation Office and on display in various Harvard libraries throughout 1991.

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strength. A high percentage of lignin in paper, for example in newsprint, will oxidize and turn the paper brown and brittle within a few years of its manufacture.

Modern developments in papermaking

In the 1880s, the first articles documenting the rapid deterioration of the new machine-made paper appeared in academic journals. However, the true cause of the problem was not fully understood until the mid-twentieth century, with the work of William J. Barrow at the Virginia State Library.

Barrow's work in the 1960s was concurrent with the formulation of new chemical additives to replace alum in the manufacture of paper. A new sizing, Aquapel®, was invented to be used with a new alkaline process of papermaking. This and other technical advances now allow for the manufacture of so-called "permanent" paper on a cost-effective basis.

Alkaline papermaking not only has a positive impact on paper quality, it also reduces the toxicity of many waste products associated with paper manufacture. Unfortunately, not all environmental issues have been solved by alkaline papermaking. Dioxin, a highly carcinogenic chemical, has been discovered in the waste from paper mills. The papermaking industry is working to understand how dioxin is produced and how to adjust the manufacturing process to eliminate it.

Recycled paper

Recycled paper is another significant twentieth-century development, one that has a positive impact on the environment, but, unfortunately, a negative effect on paper permanence. The recyling process degrades the strength of the paper fibers and combines materials that were probably manufactured with acid-producing additives. Even if recycled paper is manufactured using the new alkaline technology, its permanence is questionable. Although it is important that recycled papers be used, it is even more important that they be put to the right use.

THE NATIONAL RESPONSE TO THE "BRITTLE BOOK" CRISIS

The National Endowment for the Humanities responded to the brittle book crisis in the nation's libraries by establishing the Office of Preservation in 1985. Its activities stimulated widespread attention to the problem, and in 1986 and 1987, several Congressional hearings were held on the threat facing libraries and archives.

With urging from Congressman Sidney Yates (D-IL), Chairman of the House Interior Appropriations Subcommittee, NEH came forward at its appropriations hearing on April 21, 1988, to request a dramatic increase in the budget of the Office of Preservation, with the added funds targeted for the microfilming of brittle books. The multi-year plan outlined by NEH increased funding from $4.5 million in FY 1988 to $12.5 million in FY 1989 and provided for steady increases to $20.3 million by 1993. Congress approved the plan in principle and has since increased the budget to recommended levels.

In 1989, the Library of Congress, the National Archives, the National Endowment for the Humanities, and six other national associations and organizations sponsored an invitational conference of officers of state libraries, archives, historical

agencies, and universities. Its goal was to encourage the states to develop cooperative, statewide preservation programs.

In 1990, Congress approved a $6 million increase in the 1990 budget of the NEH Office of Preservation, specifically for a "national heritage program" to improve the preservation conditions of the nation's cultural collections held by historical museums. Richard Darman, U.S. Office of Managment and Budget Director, in an essay entitled "Preserving America's Heritage" in The Budget for Fiscal 1991, wrote:

> One might ask what "preserving America's cultural heritage" may have to do with investing in America's future. To many the connection is not obvious. . . . To the extent that investing in the future tends to emphasize technological advances—as it should—there is a need to assure a counterbalancing attention to aesthetic values. To the extent that it implies a race through time, there is a need for a balancing appreciation of history. And to the extent that America's traditional cultural values have helped make America uniquely strong, it is important that these values be preserved.

The Commission on Preservation and Access

The Commission on Preservation and Access was established in 1986 by the Council on Library Resources as a private, non-profit organization to encourage collaborative strategies for preserving and making available the deteriorating published and documentary record. The first initiative of the Commission was to help establish a nationwide "brittle books" program, which they envisioned as a coordinated, large-scale twenty-year plan to reformat on microfilm one-third of the estimated 10 million books in the nation's libraries that were becoming unusable due to paper deterioration.

Commission President Patricia Battin wrote in a 1989 editorial:

> Americans call the problem brittle books. To the Norwegians, it's sour books—*sur boker*—and to the Germans—*Bröselbuch*—or the book of crumbs. But the French use the subtlety of their language to project the true horror of the scholarly world's potential loss—*livres incommunicables*—or silent books. If the books are silent, our history is lost to us. The great voices of nineteenth-century scholarship will be stilled far more effectively and finally than by war, flood, censorship, or fire."[2]

Other initiatives of the Commission on Preservation and Access include:

- exploring image digitization and electronic storage as a preservation and access medium
- improving the longevity of all recording mediums in cooperation with authors, legislators, publishers, and manufacturers
- working internationally to create a compatible, machine-readable international database of preserved titles to insure that preservation efforts can be shared across national boundaries
- expanding the public's access to preserved materials by stimulating new thinking about the use of emerging technologies and new delivery systems to ensure equitable access.

[2] Patricia Battin, "Crumbling Books: A Call for Strategies to Preserve Our Cultural Memory," *Change* (September/October 1989).

SOLUTIONS TO THE ACIDIC AND BRITTLE PAPER PROBLEM

Making the Most of Good Fortune: Alkaline Papermaking

The development in the 1960s of a synthetic sizing agent compatible with alkaline papermaking was not in itself sufficient to change paper manufacturing, but other factors fortunately conspired to increase the number of mills "going alkaline." Inexpensive calcium carbonate was available to use as a high-quality "filler" to increase opacity and printability. Strict EPA regulations concerning waste treatment and effluent levels at paper mills encouraged the industry to switch to the cleaner, less-polluting alkaline process. Libraries and enlightened citizens have mounted an impressive public relations and educational effort to encourage manufacturers to produce alkaline paper and publishers to choose it. Although printing and writing paper accounts for less than two percent of the paper produced in the United States, the trend toward conversion of mills continues.

In October 1988, the Technical Association of the Pulp and Paper Industry (TAPPI) held an international conference on the topic of permanent paper and launched an era of greater understanding and communication among librarians, publishers, and papermakers. That same year, Senator Claiborne Pell (D-RI) introduced a Senate joint resolution to establish a "national policy on permanent paper." The House Appropriations Committee in July 1989 directed the Government Printing Office to "aggressively pursue the use of alkaline paper for inhouse and commercially procured printing" and develop a plan and a strategy to identify those government publications of enduring value that should be printed on alkaline paper. Similar initiatives have been forthcoming from the private sector as authors and publishers recognize their common stake in preventing the crumbling of our cultural and documentary heritage.

Retarding Deterioration Through Cool Storage

Although libraries and archives can expect that greater and greater portions of the new materials they acquire will be printed on alkaline paper, there remains a substantial problem in the form of millions of books and documents already printed or written on acidic paper. Whether these last indefinitely or only briefly depends on more than the materials and methods used in manufacture. It depends as well on the conditions under which they are stored.

Acids in paper catalyze hydrolytic degradation of the polymeric cellulose molecules, reducing their chain length. Even a few chain scissions per molecule cause a substantial loss of physical properties.[3] The inevitable chemical reactions that turn acidic paper into brittle, unusable paper can be substantially retarded, however, by storage in cool, dry environments.[4]

3 An overview of the chemical principles behind paper deterioration was published by Chandru J. Shahani and William K. Wilson in the May-June 1987 issue of *American Scientist*.

4 Donald K. Sebera, "A Graphical Representation of the Relationship of Environmental Conditions to the Permanence of Hygroscopic Materials and Composites" in *Proceedings of Conservation in Archives: an international symposium, Ottawa, Canada, May 10-12, 1988* (Ottawa, Canada), pp. 61-75.

J. A. Chapman was probably the first to demonstrate the importance of environmental conditions. In "An Inquiry into Perishing Paper" (*Calcutta Review*, 1911), he showed that books stored in tropical areas of India deteriorated more rapidly than the same books stored in cooler areas of northern India or in England. Since then, a considerable body of data has been developed, using accelerated aging techniques, to demonstrate that higher temperature and relative humidity facilitate the degradation of cellulose and that cool, dry environments significantly extend the life of paper.

The role of air pollution in the degradation of paper has also been studied by comparing books in heavily-polluted cities with the same books stored in rural areas. Laboratory studies have shown that paper exposed to small amounts of sulfur dioxide, nitrogen oxide, and ozone undergo substantial degradation.

Treating Acidity and Embrittlement at the Source

The technology now exists on a commercial scale to chemically stabilize acidic paper, thereby preventing embrittlement. Depending on the original strength and composition of the paper, deacidification will extend the useful life of an acidic book three to five times. Approximately two-thirds of Harvard's library collections would benefit from this treatment.

Studies conducted at the Library of Congress, Yale, and Stanford have confirmed that 25 to 35 percent of the collections of large, old research libraries are already brittle. While it is likely that most brittle materials will be reformatted onto microfilm, the Harvard collections contain many items with graphics, illustrations, and plates for which microfilm is not a suitable option. These materials should be preserved by methods that strengthen or provide support for the weakened paper. Unlike deacidification, however, low-cost paper strengthening technology is still in the research and development stage.

Deacidification: Forty-Five Years of Research and Development

Research to develop chemical methods to stabilize acidic paper and prevent deterioration and embrittlement has been undertaken steadily since the mid-1940s. A technique of aqueous deacidification was first developed by William J. Barrow, and a variation is still used by paper conservators in libraries and museums to treat individual paper artifacts.

Since the 1960s, libraries have sponsored research to find a mass solution to the problem of acidic paper—one that could be applied to whole books—and to encourage activity by the private sector. There are currently three different processes under commercial development with existing pilot plants. During mass deacidfication, whole books or groups of paper documents are treated under vacuum pressure in a chamber to neutralize the acid in the paper and leave and alkaline reserve to buffer against future acid attack from polluted environments.

Pioneer research undertaken by Richard D. Smith at the University of Chicago led to the development of a non-aqueous deacidification method—the first step towards a mass process. Smith called his process Wei T'o, after an ancient Chinese god thought to protect art against destruction from fire, worms, insects, and robbers (big or small). The process uses methoxy magnesium methyl carbonate

dissolved in chlorofluorocarbon and methanol solvents. Smith went on to devise a system to deposit the deacidification agent into whole books. The first mass deacidification pilot plant was installed in the Public Archives of Canada in 1981.

In 1987, Texas Alkyls (an affiliate of Akzo Chemical, Inc.) designed and built a pilot mass deacidification facility in Deer Park, Texas, for the Library of Congress—to perfect treatment parameters for LC's patented DEZ process, under development by LC since 1973. Under their contract, Akzo and Texas Alkyls retained ownership of the pilot plant, and in 1989, Akzo acquired an exclusive license from the U.S. Department of Commerce. Akzo is committed to making the DEZ process available to libraries worldwide.

A third process was developed by the FMC Lithium Corporation starting in 1988. The Lithco process is a non-aqueous liquid process using hydrocarbon and halocarbon soluble magnesium butoxytriglycolate to neutralize the paper and add a magnesium carbonate buffer. Lithco's pilot plant, built in 1990, is located in Bessemer City, North Carolina.

Projected at $6-$10 per book, mass deacidification is comparable to the cost of binding and thus a cost-effective preventive preservation option, and Harvard, like a number of libraries and library consortia, has established a task force to review mass deacidficiation technologies and recommend action.

Paper Strengthening: Promise for the Future

Research into paper strengthening methods has followed a parallel course to that of deacidification—from techniques developed for individual sheets to mass production methods involving treatment on a molecular level.

William J. Barrow invented a mechanized system in the 1930s to laminate brittle sheets of paper between tissue and cellulose acetate film. This method replaced the earlier hand method of "silking"—applying transparent silk to a weak document with a starch paste. Paper conservators now prefer a reversible technique of encapsulating brittle paper between thin, inert sheets of polyester film. The film is sealed on the edges by means of ultrasonic vibration.

"Leaf-casting" is a mechanized method of paper strengthening used by conservators to strengthen valuable paper artifacts. Using vacuum pressure, a slurry of paper pulp is pulled through the areas of loss in a document to fill in lacunae or strengthen an entire leaf.

In the late 1970s, Nova Tran, a subsidiary of Union Carbide, developed parylene technology, a system that deposits a clear polymer conformal coating on the surface of brittle paper. Its major use, however, has been by the electronics industry to protect delicate microcircuitry from hostile environments. Studies are underway at the J. Paul Getty Conservation Institute to qualify the use of parylene for ethnographic collections.

Under contract to the British Library, the University of Surrey has been developing a paper strengthening method using graft polymerization. Books are placed in a small chamber, doused with a chemical mix of monomers, and irradiated with gamma rays to change the monomers to polymers. The British Library is seeking financing for a pilot plant.

When paper strengthening becomes a viable commercial option, Harvard's libraries will want to take advantage of this technology for selected brittle materials, particularly those with illustrations.

Preservation and Access: Brittle Book Replacement and Reformatting

Research libraries and archival repositories began using microphotography in earnest in the mid-1930s to make rare and scarce materials—and frequently whole collections on a particular subject—more widely available. As paper deterioration became an urgent problem, microfilming became an accepted method of preserving the intellectual content of a deteriorated item.

In 1968, twenty years before Congressman Yates held the hearing on increasing the funding for a national brittle books program, the Library of Congress launched a Brittle Book Project with funding from the Council on Library Resources and began publication of the *National Register of Microfilm Masters*. The *Register* is now being converted to machine-readable form through a project sponsored by NEH and the Andrew W. Mellon Foundation. In the 1990s, the concept of a decentralized "national" collection of master negative microforms is widely accepted. At $60-$90 per volume, preservation microfilming is best operated as a coordinated national program in which libraries share the information that an intellectual work has been preserved and make low-cost copies available to other libraries.

Microfilm to Image Technology

In 1983, the National Micrographics Association changed its name to the Association for Information and Image Management (AIIM). The name change reflected a revolution in the development of electronic imaging technology and new applications in all areas of information storage, retrieval, display, and dissemination.

Like microfilm, electronic digitization involves taking a "picture" of the page as it exists. Whereas microfilm stores a miniaturization of the page directly onto a gelatin emulsion on a polyester film base, digitization records the image of the page electronically as a series of 1's and 0's—known as bits. Microfilm images are stored on 35mm film, but digitized images may be stored on a variety of formats, including magnetic disk, optical disk, digital video tape, magnetic tape, and CD-ROM.

Image Quality

The silver-halide film typically used for preservation microfilming produces a high-resolution (sharp) image at approximately 1000 dpi (dots per square inch). Digital scanning is typically 200-400 dpi. Higher resolution is possible but adds considerably to storage cost. For example, doubling the number of dpi uses four times as much space on an optical disk. However, 300 dpi corresponds to the resolution of most laser printers and is an acceptable resolution for many applications.

Microfilming and digitization are only capable of reconfiguring an item—they do nothing to preserve it in its original state. In the case of straight text, the reconfiguration may be acceptable to the user, and even desirable if it facilitates access. However, those who need the original image for purposes of duplication, or who rely on a comparison of images to support their research, are not well served by surrogates. Neither microfilm nor digitization, for example, reproduces halftones clearly, and subtle gradations of color may be either entirely lost or distorted.

Preservation Medium

The use of microfilm as a preservation option is predicated on the assurance that microfilm is a permanent (300 years or more) storage medium. Although digital storage media are being constantly improved, manufacturers typically quote a mere 10 to 20-year storage life. Digital signals can, however, be regenerated indefinitely without loss, even though the medium might degrade. To do so costs money, and librarians are keenly conscious of the danger that the digital signals might not be regenerated in time to prevent loss.

Turn the Pages Once

Preservation reformatting—whether by filming or by electronic digitization—involves selecting and preparing materials to film. It also requires turning the pages one-by-one to make a copy. These parts of the process are the most labor-intensive —regardless of the choice of reformatting technology. It may be that the two will work together in the future. In one possible scenario, microfilm may serve as the means of capturing texts archivally, with those images being converted to digital form for dissemination and use.

Regardless of the reformatting technology used, the result is a duplicate copy of a previously-published work. The challenge for library bibliographic data bases is to clearly represent the intellectual work and its "multiple versions" to the library user. A plethora of formats and descriptions can impede instead of enhance access. Likewise the national data bases are used to record the information that a particular work has been preserved. This is the basis for contributions by many libraries to a coordinated nationwide preservation program.

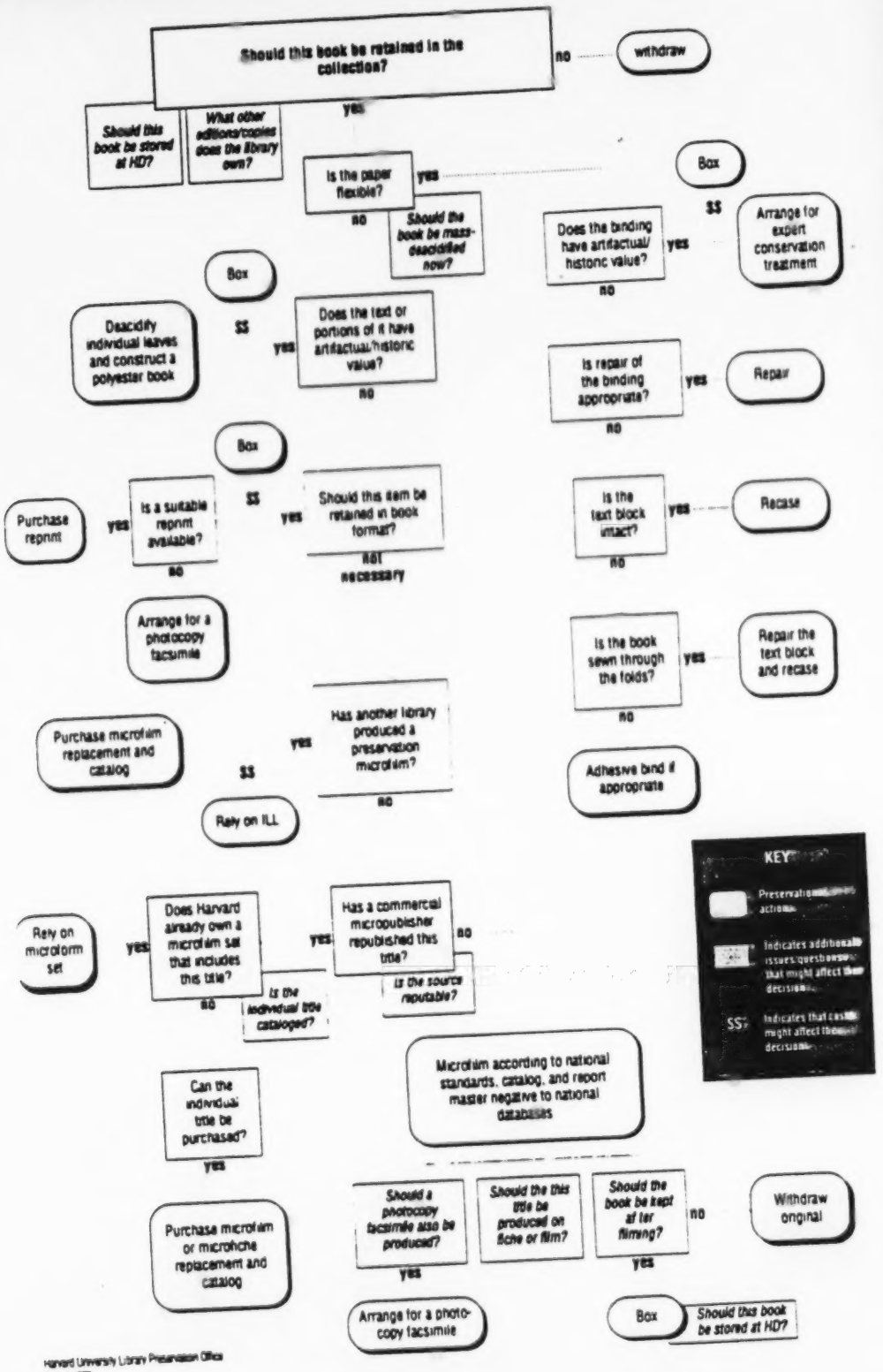
The Solutions Applied

A combination of these solution to the brittle and acidic paper problem—cooler storage environments, mass deacidification, paper strengthening, and microfilming of brittle books—will allow Harvard to maintain its extraordinary collections for use. Modern paper, in its "new" alkaline form, will probably continue to be the most common capture, storage, and access technology used for library materials. However, the newer electronic and optical technologies combined with computer access are already changing the face of library service. These technologies will enhance access to information, including the information resident in several generations of brittle books that must be transferred to microfilm to save their intellectual content.

Harvard University
Preservation Office

Preservation Workflow

for a worn, damaged, or deteriorated book in the research collections



Harvard University Library Preservation Office
March 1992

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SELECTED READINGS

Selected Readings

Adkins, Susan. "Saving Brittle Books: An Annotated Bibliography of Preservation Options." In *Collection Management* 13 no. 4, 1990, pp. 53-63.

The Archives of the Future: Archival Strategies for the Treatment of Electronic Databases. Washington, DC: National Academy of Public Administration, 1992.

"*Book Photocopying Guidelines.*" The RLMS Copying Committee, Subcommittee on Photocopying Guidelines. **To be published in an upcoming ALCTS newsletter.**

"Brittle Books Programs." *SPEC Kit* 152, March, 1989. Washington, DC: Association of Research Libraries, Office of Management Services.

Clark, Lenore. *Guide to Review of Library Collections: Preservation, Storage, and Withdrawal.* Chicago, IL: American Library Association, 1991.

Guide to Preservation in Acquisitions Processing. Chicago, IL: American Library Association, **The projected publication date for this document is late 1992.**

Kenney, Anne R. and Lynne K. Personius. *Joint Study in Digital Preservation: Phase 1.* Washington, DC: The Commission on Preservation and Access, September, 1992.

Lynn, M. Stuart et al. *Preservation and Access Technology. The Relationship Between Digital and Other Media Conversion Processes: A Structured Glossary of Technical Terms.* Washington, DC: The Commission on Preservation and Access, August, 1990.

Oakley, Robert L. *Copyright and Preservation: A Serious Problem in Need of a Thoughtful Solution.* Washington, DC: The Commission on Preservation and Access, September, 1990.

Preserving the Illustrated Text: Report of the Joint Task Force on Text and Image. Washington, DC: The Commission on Preservation and Access, April, 1992.

Walker, Gay. "Preservation Decision Making and Archival Photocopying: Dealing with Brittle Books at the Yale University Library." In *Restaurator* 8 no. 1, pp. 40-51.

Waters, Donald J. *From Microfilm to Digital Imagery. A Report of the Yale University Library.* Washington, DC: The Commission on Preservation and Access, September, 1992, p. 1-18.